

International Scientific Migrations Today

New Perspectives



International Scientific Migrations Today New Perspectives

Proceeding of the symposium held in Bogotá, the 24-25-26 of june 1996

Jorge Charum, Jean-Baptiste Meyer Editors

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Introduction

A New Form of Disseminating the Results of Scientific Works

Jean-Baptiste Meyer

Jorge Charum

This CD-ROM holds the proceedings of the symposium " International Scientific Migrations Today : new perspectives " which took place in Santafé de Bogotá, Colombia, the 24-25-26 of June 1996. The event gathered 45 speakers from 25 countries and most of the contributions presented are published here in this volume. As any international scientific meeting of that kind, this one has been the opportunity to display many different case studies, points of view and approaches. Each of these has brought interesting elements and considerations for the knowledge and understanding of the international circulation of skills at the end of this millenium. In order to preserve this wealth of information and not to reduce the heterogeneity of the situations exhibited in the symposium, an adequate -and still new- way of publishing the proceedings has been chosen : the CD-ROM. 40 presentations are thus made available, often in two languages : all of them are in english and 2/3 are also in spanish and/or french, according to the native language of their authors. The abstracts are all available in the three languages. We thus hope to facilitate the largest access to these texts at a lower cultural and financial cost, thinking especially in the developing countries where the issue of intellectual migrations is crucial.

The CD-ROM cannot be compared with a classical book. It cannot be compared either with grey litterature. It is also different from the symposium itself. In fact, it retains a part of these three modalities of research dissemination and has also something more. Thanks to its size, the CD contains a large number of contributions. Therefore, it respects the diversity of the meeting's communications eventhough they have gone through a selection and revision process in order to fit with an editorial and intellectual unit and to be presented under a uniform manner, like a book. But at the same time, besides highly elaborated presentations, the CD includes works in a transitory stage which are more a matter of exchange, specific information and discussion, like documents of grey litterature or semi-formal communications at a meeting. In this way, the present volume combines different characteristics of various ways of scientific knowledge diffusion.

The CD has limitations that the reader will certainly discover. However, it has a definite advantage : it delivers with flexibility a mass of information in which one can look for, move, pick up or associate, extract and use elements according to one's interests and needs. Though technically simple (it has not been conceived as an hypertext), the CD offers possibilities to use links for quick moves within the text and immediate transfers for use in other ones. This new form of disseminating the results of scientific works may invite the reader to a hunter-gatherer behavior breaking with the cultivation-accumulation intellectual process of more traditional ones. However, here, the " jungle " has been organized to help everyone find his way and compose his own diet. The volume is divided in 6 parts, preceded by an introduction and followed by a conclusion, in a linear classical manner that the reader is free to follow or to leave aside. The figures in parenthesis indicates the number of chapters in each section.

The Introduction section (2) : besides these preliminary comments, it includes a general and philosophical presentation made by the mayor of Bogotá, the capital of Colombia where the symposium has been held.

Part 1, Historical and Conceptual Framework (4), gives theoretical perspectives to the issues considered in the volume.

Part 2, Migrations, Networks and Scientific Communities (5), links the aspects of the circulation of skills with those of fluid or stable entities.

Part 3, The Conditions and dynamics of Migrations : Case Studies (8), describes various recent examples of migratory situations.

Part 4, Socio-economics and Socio-politics of Scientific Migrations (5), refers to economic and political dimensions, influencing or resulting from migrations in S & T.

Part 5, The Return of Students and Researchers (5) brings comparable examples of policies or programmes for the return of the highly qualified expatriates.

Part 6, The Diaspora Option (10), describes recent experiences in the original strategy which consists in the remote connection of the expatriates to their country of origin.

The last section (2) contains a tentative synthesis and a final conclusion of the symposium.

Acknowledgements

Many organizations have supported the symposium from which this volume is issued. We wish to thank them all for having permitted this event in multinational cooperation to take place.

* COLCIENCIAS, Instituto Colombiano para el Desarrollo de la Ciencia y la Tecnologia, Francisco José de Caldas

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* Universidad Nacional de Colombia

We also would like to thank the IOM (International Organization for Migrations) and the UNDP (United Nations Development Programme) for having facilitated the participation of some of their staff members.

Finally, we wish to thank the scientific and organizing committees. They have been decisive in the intellectual and practical preparation of the symposium and this publication owes very much to their efforts.

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Una nueva manera de diseminar los resultados de los trabajos científicos

Jean-Baptiste Meyer
Jorge Charum

Este CD-ROM contiene las actas del simposio « Migraciones científicas internacionales hoy : nuevas perspectivas » que tuvo lugar en Santafé de Bogotá, Colombia, los dias 24-25-26 de junio 1996. Este evento reunió a 45 especialistas venidos de 25 paises y la mayor parte de las presentaciones están publicadas en este volumen. Como cualquier encuentro científico de ese tipo, este fue la ocasión de desplegar numerosos estudios de casos, puntos de vista y perspectivas distintas. Cada uno de estos ha propuesto elementos y consideraciones de interés para el conocimiento y la comprehensión de la circulación internacional de competencias al final de este milenio. Con la preocupación de preservar esta riqueza de información y de no reducir la heterogeneidad de las situaciones presentadas durante el simposio, una manera adequada -y todavia nueva- de publicar las actas a sido adoptada : el CD-ROM. 40 presentaciones estan asi disponibles, seguido en dos idiomas : todas estan en inglés y 2/3 de ellas aparecen también en español y/o en francés, según la lengua maternal de sus autores. Los abstracts estan disponibles en los tres idiomas. Esperamos asi facilitar el acceso mas amplio a estos textos, a un costo cultural y financiero minimo, pensando especialmente en los paises en desarrollo para los cuales la question de las migraciones intelectuales es crucial.

El CD-ROM no puede ser comparado con un libro clásico como tampoco con la literatura gris. También es diferente del mismo simposio. De hecho, conserva una parte de los atributos de estas tres modalidades de diseminación de la investigación pero también tiene algo más. Gracias a su tamaño, el CD contiene un alto numero de contribuciones. Asi respeta la diversidad de las comunicaciones hechas durante el encuentro, aun si pasaron por un proceso de selección y de revisión para insertarlas en una unidad editorial e intelectual y estar presentadas de una manera uniforme, como un libro. Pero al mismo tiempo, paralelamente a unas comunicaciones muy elaboradas, el CD incluye trabajos que estan todavía en un estadio transitorio y que son más objetos de intercambio, de información específica o de discusión, como los documentos de literatura gris o como comunicaciones semi-formales en un encuentro. De esta manera, el presente volumen combina diferentes caracteristicas de varios medios de difusión del conocimiento científico.

El CD tiene limitaciones que el lector descubrira. Sin embargo, tiene una cierta ventaja : entrega con flexibilidad una masa de información en la cual uno puede buscar, desplazarse, aislar o asociar, extraer y utilizar elementos según sus propios intereses y necesidades. Aunque es tecnicamente sencillo (no fue concebido como un hipertexto), el CD ofrece posibilidades de hacer relaciones para desplazamientos rapidos dentro del texto y para transferencias inmediatas en vista a utilisaciones en otros textos. Esta manera nueva de diseminar los resultados del trabajo científico puede invitar el lector a una actitud de cazador-recolector, rompiendo con el proceso intelectual de cultura-acumulación asociado a las formas mas tradicionales. Sin embargo, aqui, la « jungla » ha sido organizada para ayudar a que cada uno pueda encontrar su camino y componer su propia dieta. El volumen esta dividido en 6 partes, precedidas de una introducción y seguida de una conclusión, de una manera linear clasica que el lector esta libre de seguir o dejar de lado. Las cifras entre paréntesis indica el numero de capitulos en cada una de las secciones.

La sección introductiva (2) : a parte de estos comentarios preliminares, incluye una presentación filosófica y general hecha por el alcalde mayor de Bogotá, ciudad capital de Colombia donde tuvo lugar este simposio.

Parte 1, Marco historico y conceptual (4), prove perspectivas téoricas sobre las questiones tratadas en este volumen.

Parte 2, Migraciones, redes y comunidades científicas (5), relaciona los aspectos de la circulación de competencias con los de entidades estables o fluidas.

Parte 3, Las condiciones y dinamicas de las migraciones : estudios de casos (8), describe varios ejemplos recientes de situaciones migratorias.

Parte 4, Socio-economia y socio-politica de las migraciones científicas (5), hace referencia a las dimensiones económicas y políticas, que influyen o resultan de las migraciones en CyT.

Parte 5, El retorno de los estudiantes e investigadores (5) trae ejemplos comparables de programas o de políticas de retorno de los expatriados altamente calificados.

Parte 6, La Opción Diáspora (10), desribe experiencias recientes de esta estrategia original que consiste en la mobilización a distancia de los exatriados por su pais de origen.

Agradecimientos

La ultima sección (2) contiene una syntesis y una conclusión del simposio.
Numerosas organizaciones han apoyado la realización del simposio de donde salio este volumen. Deseamos agradecerlas todas por haber permitido que este evento de cooperación multinacional pudiera realizarse.

* COLCIENCIAS, Instituto Colombiano para el Desarrollo de la Ciencia y la Tecnologia, Francisco José de Caldas
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* Universidad Nacional de Colombia

Quisieramos igualmente agradecer la OIM (Organización Internacional de las Migraciones) y el PNUD (Programa de las Naciones Unidas para el Desarrollo) por haber facilitado la participación de uno de sus agentes.
Finalmente, deseamos agradecer particularmente los comités científicos y de organización, por sus decisivos aportes en la preparación intelectual y practica del simposio y a cuyos esfuer-

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Une nouvelle manière de diffuser les résultats du travail scientifique

Jean-Baptiste Meyer

Jorge Charum

Ce CD-ROM contient les actes du symposium « Migrations scientifiques internationales aujourd'hui : une problématique nouvelle » qui s'est tenu à Santa Fe de Bogotá, Colombie, les 24-25-26 juin 1996. Cet événement a réuni 45 spécialistes venus de 25 pays et la plupart des contributions présentées sont publiées dans ce volume. A l'instar de toutes les rencontres scientifiques du même type, celle-ci a été l'occasion de déployer de nombreux cas d'étude, de points de vue et d'approches différents. Chacun d'entre eux a apporté des éléments et des considérations intéressantes pour la connaissance et la compréhension de la circulation internationale des compétences à la fin de ce millénaire. Avec le souci de préserver cette richesse d'information et de ne pas réduire l'hétérogénéité des situations présentées durant le symposium, une façon adéquate - et encore nouvelle - de publier les actes a été adoptée : le CD-ROM. 40 présentations sont ainsi rendues disponibles, souvent dans deux langues : toutes sont en anglais et les deux tiers d'entre elles apparaissent également en espagnol ou/et en français, selon la langue maternelle de leurs auteurs. Les abstracts sont disponibles dans les trois langues. Nous espérons ainsi faciliter l'accès le plus large possible à ces textes à un coût culturel et financier minimal, en pensant spécialement aux pays en développement pour lesquels la question des migrations intellectuelles est cruciale.

Le CD-ROM ne peut guère être comparé à un livre classique, ni à la littérature grise. Il est également différent du symposium lui même. De fait, il retient une partie des attributs de ces trois modalités de dissémination de la recherche mais il a aussi quelque chose en plus. Grâce à sa taille, le CD contient un grand nombre de contributions. Il respecte par conséquent la diversité des communications faites pendant la rencontre, même si elles sont passées par un processus de sélection et de révision, afin de s'insérer dans une unité éditoriale et intellectuelle et afin d'être présentées d'une manière uniforme, comme un livre. Mais en même temps, parallèlement à des communications très élaborées, le CD inclue des travaux à un stade transitoire et qui sont plus l'objet d'un échange, d'une information spécifique ou d'une discussion, comme des documents de littérature grise ou des communications semi-formelles à une rencontre académique. De cette façon, le présent volume combine différentes caractéristiques de divers moyens de diffusion de la connaissance scientifique.

Le CD a des limitations que le lecteur découvrira. Cependant, il a un avantage certain : il livre avec flexibilité une masse d'information dans laquelle celui-ci peut chercher, se déplacer, isoler ou associer, extraire et utiliser des éléments selon ses propres intérêts et nécessités. Quoique techniquement simple (il n'a pas été conçu comme un hypertexte), le CD offre des possibilités de faire des liens pour des déplacements rapides à l'intérieur du texte et pour des transfers immédiats en vue d'utilisation dans d'autres textes. Cette nouvelle façon de diffuser les résultats du travail scientifique peut inviter le lecteur à un comportement de chasseur-cueilleur rompant avec le processus intellectuel de culture-accumulation induits par les formes plus traditionnelles. Néanmoins, ici, la « jungle » a été organisée pour aider chacun à trouver son chemin et composer son propre menu. L'ouvrage est divisé en 6 parties, précédées d'une introduction et suivie d'une conclusion, d'une manière linéaire classique que le lecteur est libre de suivre ou de laisser de côté. Les chiffres entre parenthèses indiquent le nombre de chapitres dans chaque section.

La section introductive (2) : outre ces commentaires préliminaires, elle inclue une présentation philosophique et générale faite par le maire de Bogotá, capitale de la Colombie, où ce symposium s'est tenu.

Partie 1, Cadre historique et conceptuel (4), donne des perspectives théoriques sur les questions traitées dans ce volume.

Partie 2, Migrations, réseaux et communautés scientifiques (5), relie les aspects de la circulation des compétences avec ceux d'entités stables ou fluides.

Partie 3, Les conditions et dynamiques des migrations : cas d'étude (8), décrit divers exemples récents de situations migratoires.

Partie 4, Socio-économie et socio-politique des migrations scientifiques (5), fait référence aux dimensions économiques et politiques, influençant ou résultant des migrations en S & T.

Partie 5, Le retour des étudiants et chercheurs (5) apporte des exemples comparables de programmes ou de politiques de retour des expatriés hautement qualifiés.

Partie 6, L'Option Diaspora (10), décrit des expériences récentes de la stratégie originale consistant en la mobilisation à distance des expatriés par leur pays d'origine.

La dernière section (2) contient une synthèse et une conclusion du symposium.

Remerciements

De nombreuses organisations ont soutenu la réalisation du symposium dont cet ouvrage est issu. Nous souhaitons les remercier toutes d'avoir permis que cet événement de coopération multinationale ait lieu.

* Colciencias, Instituto Colombiano para el Desarrollo de la Ciencia y la Tecnologia, Francisco José de Caldas
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Nous aimerions également remercier l'OIM (Organisation internationale des migrations) et le Pnud (Programme des Nations unies pour le développement) d'avoir facilité la participation de certains de leurs agents.

Finalement, nous souhaitons remercier vivement les comités scientifiques et d'organisation. Ils ont été décisifs dans la préparation intellectuelle et pratique du symposium et cette publication doit beaucoup à leurs efforts.

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Introductory Remarks

Antanas Mockus Sivickas

This event can be seen as the meeting of an International, similar to the one Borges refers to in his poem “Los Conjurados”: people who decided several centuries ago to have faith in rational discussion. The part of this international that is meeting here has been looking at how academics migrate and become rooted. Their work identifies a tension between the general ways of thinking about contemporary society.
Some of us only see individuals. Others see or prefer to see relations. If we look at migration from both of these perspectives we see something quite different : either individuals who move from one place to another or else relations that somehow come apart, are severed, while other relationship bonds are forged or strengthened, even before the migration. Thus a selective process takes place ; something similar to what some of you have been studying according to the summaries I’ve read : a selection of the skills that operate in the new context. If one ceases to see the movement of the individual and sees migration as modification to the social web, in the point of origin and the destination, or as a transfer of knowledge, then one can see some very interesting things.

The study of migration tell us a lot about the societies. A debate show up in the papers that has to do with the paradox of this moment in history. On one hand, societies in the context of the increasingly internationalized market economy and, on the other hand, societies of knowledge, societies where knowledge is the decisive source of productivity and power. Trying to accommodate both perspectives at the same time leads to difficulties in interpreting the situation : whereas some will see the circulation of knowledge and knowers from the point of view of the commodities paradigm, others will show that this reading is very limited.

I would like to enter the discussion at this point and first of all address the circulation of knowledge and then the circulation of knowers. The circulation of knowledge, in contrast to the circulation of things, of goods, requires strong mechanisms for selecting, prioritizing and for customizing, adapting knowledge so that it can put down roots in a new context. I take knowledge from one context and transfer it to another, but in taking it I must be selective, I can’t take it all. Secondly, after selecting it, I probably will have to modify its internal, hierarchical, logical relations : what was a corollary there may be a theorem here, and what there was a theorem may here be a corollary. Thirdly, after restructuring, this knowledge, which has been removed from its original context, from the turns of phrase, from the practices that accompanied it in the original context, must be linked to the practices, to the turns of phrase of the destination context. Transfering knowledge from one place to another turns out to be a much more complex operation than moving material goods from one place to another.

The interaction between those who produce and create knowledge and those who recontextualize knowledge can be fruitful. The process of selecting, prioritizing and customizing to another context may produce changes in the original context. But the key is that in order for knowledge to circulate it must be distorted, readapted, restructured or reconstituted. And this takes place through various steps in such a way that the process is repeated several times and in the end the content is considerably different from that with which it started out. Physics, as understood by a high school graduate in Italy or Colombia, is far removed from the physics of physicists, even the classic physics of two or three centuries ago. The wonder is that despite the distortion, some of those who first were introduced to the more distorted version will gradually arrive at versions that are closer to the truth and some will manage to interact fluidly

with those who produce knowledge at the source. Furthermore, no one can produce genuine, original knowledge without having come by way of the versions that are supremely simplified and distorted so that they make sense and are useful in diverse contexts, which are nearly always foreign to the level of production of knowledge.

By recognizing this structure for reproducing academic knowledge, by simply looking at the different levels of the system in society, one can appreciate the enormous importance of those who can become familiar with and work with at least two different levels of the process, those who can learn and teach in two different contexts, those who, for example, manage – even once in their lifetime – to contribute to a discussion with those who produce original knowledge, while at the same time working in other contexts. These individuals would probably be the best recontextualizers.

Let us imagine an educational society in fifty or a hundred years, in which the most highly valued commodity would be a conversation or an analysis that reorganizes the mental files. There, the selection of what may be pertinent, what may be relevant, what would contribute to a fruitful relationship with that which the people already know, will become decisive because it would define what I could contribute and what another could contribute to me. A society of knowledge depends fundamentally on recontextualization processes.

Contemporary circulation of knowledge, the very functioning of science and education, requires – if you will pardon the metaphor – little “ migrations ” : migration between levels of the educational system, migration to a country’s best universities or between the world’s great universities, to come and go, to be able to participate fruitfully in the conversation in one and the other, with the ability to customize, to translate, to simplify in order to contribute to the enrichment of knowledge at each level. Locally, in one or another context, the ears must be kept open and ties must work properly. *The one who recontextualizes is only partly the recontextualizer.* Basil Bernstein’s research at the University of London [1] shows that normally rather than being a distinct conscious effort, the processes of selection, prioritization and adaption-insertion of knowledge in a new context, are some of the mechanisms for reproducing society. A good part are implicit and involve multiple state and private agencies that develop and disseminate consciousness and identity. Something obvious can be concluded : more than successful emigrants, there are successful migrations.

If we wish to underline the challenges that cultural diversity brings to society and how cultural diversity among societies affects the circulation of knowledge, it is worthwhile trying to see the recontextualizer as a *cultural amphibian* while asking ourselves about the conditions in which societies take in and make use of this amphibian.

What is a cultural amphibian ? At first sight this person would appear to be a chameleon who lives by the well known adage of René Descartes, they do there as they see done. But if he only adapts he will not act as a vector, as the selective transporter of knowledge. The cultural amphibian learns different games, he integrates himself into different systems of practices and at the same time assures the selective transportation of fragments of knowledge. Two considerable challenges are encountered : the quality of the recontextualization, integrity.

Circulation of knowledge is only possible if there is recontextualization (selection, prioritization, adaption). Now let us consider migration as recontextualization ; a mix of knowers and knowledge. First, let us consider a movement of people as a recontextualization of people. Then let us consider each person’s store of knowledge and how, to put it one way, his links, his ties go through marked restructuring when changing contexts. Some ties are severed or weakened, other ties are created or strengthened. Who prioritizes, who adapts, who chooses what skills will be most useful in the new context, will grow more in it, what things will become more readily available, what things will remain hidden in the shadows ? At the same time, what makes cultural traditions open up to a greater or lesser degree, and in a more or less

conscious manner, to accept these interlocutors who at some point may be the “external” bearers of what is essential to each tradition ? It is very difficult to separate out, but one could say that the market influences this, but not that it determines everything.

What is the difference between a cultural amphibian and a migrant ? Probably every migrant, at some point during his life, is tempted by the option of the cultural amphibian. To greatly simplify things, we can consider migration as a sort of initiation rite into a new culture. And some of us, on finding ourselves initiated into a new culture say to ourselves, just a minute, is this reversible? Anyone who has studied anthropology knows that it is not reversible. So the question changes, could it be that I may retrace my steps through the initiation tunnel and return to the culture of origin, to again relate, to again converse with those who once surrounded me or once made up my world? The answer is : perhaps yes, but at this time, if you circulate freely between two different worlds, you are addressing the issue of whether you truly can belong to two different cultural traditions. I don’t know that the answer to this can be yes, but exploring the possibility is very interesting. It is similar to the much more radical issue of whether one can conceive of a religious amphibian.

Modernity differentiates between culture, morals and the law, following the path set out by the Greeks. Diogenes demonstrated through his actions that morals are above culture and Socrates’death illustrated the tension between moral commitment and the law. Socrates allowed that the law could be broken for moral reasons, but he did not expect to evade the consequences of breaking the law. Legislators and judges listen, but once a norm has been established and applied, the individual must respect society’s order. If I cannot opportunately persuade my society that what I did was right, society may punish me and I must comply with this decision. Some writers summarize this as “if you can’t persuade, you must obey” Thus a tension between individual constitution and respect for social order is there from the start.

In the case of the amphibian, the tension is much more marked : it is no longer merely my individuality versus society, but my individuality versus two societies, two worlds as reference points. The amphibian, as well as actively respecting two different cultures, is somehow responsible for his ties and for the circulation, though selective, of knowledge between one and the other.

I am aware that by raising the issue of the amphibian I return to looking at things from the individual paradigm. Even so, it helps address all that takes place when an individual moves from one place to another.

Migrations of people and knowledge helped separate culture from morals, this was clear to Diogenes, and to separate morals from the law, which was clear to Socrates. Probably for most contemporary societies this separation is quite clear, moral rules are generally rules that govern individuals and somehow society’s constant message is that each individual must develop his moral sense. Great moral thinkers like Kant have even said “you can invent your own rules, but all you will obey is a meta-rule, a rule of rules: what follows are rules that you wish everyone else would follow”. Morals develop autonomously or apparently autonomously. Customs also regulate behavior (and clearly there are societies that are tolerant of a diversity of customs and beliefs) and the legal system consists of explicit laws, with clear penalties, authorities to carry out the penalties, clear procedures to apply the penalties. Morality punishes through unease or guilt, culture punishes through exclusion, by censure, by rejection. Culture tries to tap into feelings of shame and the law makes use of explicit penalties such as prison, detention and fines.

We are dealing with three regulatory systems that operate relatively independently. In general, morals are more demanding than culture, culture is more demanding than the law, the law need only be applied when the constraints of morals or culture fail. Few individuals are dissuaded by a fear of legal sanctions, most individuals are regulated and dissuaded through their individual morals and by the cultural rules of their reference community.

I return to the cultural amphibian. The cultural amphibian must develop his morals in order to relate to two different cultural traditions, with two different systems of cultural rules. Looking

at the history of religion and the struggles between religions, it can be seen that rival religions set out rules that clearly could not be obeyed simultaneously. So the religious amphibian had to keep private part of his religious practice, he could not make an appearance in synagogue on Saturday and in church on Sunday. Religious rituals serve to link the internal world, the moral world, to the external world.

Does migration create cultural amphibians or do some migrants maintain such strong ties with their place of origin that they find themselves caught in this type of problem ? I believe that the latter is true, although I am not sure that this applies to all migrants. It is possible that at a given moment one simply changes from belonging to one culture to belonging to another culture. Some of the discussions you have held address the challenge of what we can call dual belonging. The still very precarious, very rustic experience of the Caldas Network (which will be the object of analysis in this event) seeks to achieve that Colombian researchers who are located elsewhere continue to be " from here " and that they dedicate some of their energies, some of their time, to conserving ties with Colombia as a vital point of reference. The Network consists basically of a mailing list which Colombian researchers use to communicate with each other. It makes use of technology to try to keep up contacts, between them and with their culture of origin. Part of this culture of origin is manifested by the fact that the Network is used more for culturally valid purposes than for scientific discussion. This little emigrant's refuge evidently does not preclude other possible uses.

Many of our societies would gain enormously if their non-resident scientists considered themselves to be cultural amphibians. This is greatly facilitated nowadays by the strides that have been made in communications and transportation : it is increasingly easier for a person who has emigrated to return, even if only for a few days. This circulation affects making ties, acquiring skills, the use of these skills, the selective use of these skills. For me this is an intriguing subject.

Now I would like to discuss the relevance of this to the Colombian situation. In Colombia many illegal behaviors are culturally acceptable. It is possible that to some degree, though generally to a lesser degree, this takes place in all Latin American countries. The strength of what is known as the informal economy shows that somehow it is functional within the system, that not everyone operates within the law and this means that culturally environments are created in which the illegal, and probably sometimes the immoral, are acceptable. So a great tension, similar to the tension of the cultural amphibian, exists in the general population. There are people who know that the law sets this limit, who morally probably can see the value and justification of the law and yet they are strongly enticed by the cultural context to live by cultural rules that are in discord with the moral rules and the legal rules. Thus many people may experience tension between their moral identity, the national legal framework and their practices. So many people are subject to simultaneously obeying various rule systems. The tension experienced by the migrant scientist may be similar to that of the citizen who lives amidst the divorce of law, morals and culture.

Scientific migration can help us to visualize, like a lab experiment and with a high degree of self-consciousness, tensions that are frequently experienced in the internal lives of our societies. For a scientist, migration within a society like ours can often be as complex as transplanting that scientist from one place to another. What is the difference in this comparison ? That in one way or another, those of us who have had a certain initiation into the academic culture believe that we belong to a broader community on the international level. To a certain point the notion of an international scientific community is a fiction, but with elements of reality : publications, communication, exchange and above all a reality that illustrates, within this group, the strength of honest communication. To simplify greatly, the scientific community is the illustration of a humanity that interacts based on an honest recognition of reasons. So we have people, some who belong to two cultures, some who belong to just one, who nonetheless can work in the same business. It can also be observed that each person or nation is promoting its own busi-

ness but that it needs honest interaction with others, with those who are different. In any case, honest communication is fundamental to the work of the international scientific community. What can society learn from the international scientific community ? That cultural diversity can be fully achieved, not merely tolerated – please act and think differently – but by administering the living richness of the exchange between different traditions and between very distinct cultural groups. What can people learn from scientific migration and from certain elements of the basic structure of the international scientific community ? They may learn something very strange : *to trust honest communication* while understanding that honest communication is not automatic. There will always be interpretation problems, always what I say may be heard differently from what I intended ; and, on the other hand, there is an *awareness of the arbitrariness and complexity of the interpretations.* In the interface between different cultural traditions, selection, prioritization and selective appropriation of knowledge are crucial so that cultural diversity will be possible and fruitful. In some way we need very responsible cultural amphibians and migrant scientists are but one possible and privileged example of these.

Bogotá, the city in which we live, is a very curious city. It is a city whose name is written out in two different ways by the newspapers : some write it Santafé as one word and others write Santa Fe separately. The Bogotá flag is often seen throughout the city, not flying but rather painted on store windows and vendors carts. Furthermore, sometimes maps of the city are drawn with the north at the top, sometimes they are drawn with the north to the left, and sometimes they are drawn with the north to the right. It is a city that to some degree understands that conventions are conventions, but that often forgets that conventions must be universal in order to function. These strange characteristics of the city would seem to correspond to a city of migrants. They illustrate well the limitations of what could be a fruitful exchange. If the conventions were more widely shared, if there were more common rules, the city would be more fruitful. If we say that establishing common rules leads to the problem of *whose* rules, probably none of the traditions present would be willing to accept that another group impose its rules or traditions.

The origins of laws, morals and culture cannot easily be differentiated in current societies. There are authors who examine their interrelationship. Rawls, for example, says that the same law can be supported by different cultural traditions and that this should be so in order for the law to function. Author such as Durkheim and MacIntyre say that the investigation of individual morals in cultural traditions is suicide because it is a self-defeating process. Empirically there are societies that pay a very high price for this, in Colombia there are 26,000 deaths per year caused by the divorce between that which is culturally, legally and morally acceptable. Laws, morals and culture have become differentiated but in some cases this leads human behavior in different directions and thus people who are able to respect not just the superficial but the deeper elements of two or more cultural traditions become key. It is possible that as they grow, societies need to continue to generate this type of alteration, of hybrids, of people who somehow guarantee the fruitful interaction between different societies or between strongly differentiated sociocultural groups within the same society. Is this compatible with honest, frank, permanent communication ? Machiavelli placed great store in the lie : the price for articulating different social actors is sometimes, obviously or secretly, the lie. If one tries to transfer the different internal life experiences of academic communities or societies as complex as ours, one may be tempted to ask what would happen if there were permanent sincerity. The risks of failure are extremely high, but the process would be supremely interesting.

There is an even more critical way of seeing this, and that is to consider belief in honest communication to be totally ingenuous. Even so, it is worth mentioning that in some cases society must turn to ingenuity as the only way of avoiding cynicism. There is a Soviet film, set during the fifties, in which a series of mayors from a small town are murdered. So the townspeople decide to elect the village idiot as mayor because he has no enemies. It is likely that the village idiot and the cultural amphibian share a broad range of characteristics that would be interesting for us to evaluate.

I apologize for the local references I have brought up in this international event. You are going to discuss problems in their universality and generality. I have made reference to the Colombian situation to better explain the enthusiasm with which we embrace people like you and an event like this, as a source of awareness, as a source of understanding.

Maybe in the future the paradigm of negotiation will be compared to the paradigm of translation. Right beside the Harvard manuals on how to negotiate without giving anything up, how to define and advance objectives, etc., research will appear on " what is your agenda and let me see if I can translate it so that it is compatible with my agenda ". Help for someone who has no grand plan, no great historical utopia that purports to put everything in its place, that contributes to recognizing the common points between less ambitious agenda, and serves greatly in that nearly no one brandishes the grand plan in order to shut out others.

In an exchange between modest agenda, there are translations that in some way discover the local compatibility between different agenda. The self-representation of different actors in conflict may be as important as achieving results. Many people would yield on the results if they were only given due consideration in the reading that others make of their vision and actions. Again, the coexistence of different agenda comes to have a logical structure that greatly resembles that of the cultural amphibian: I can, without straining my moral integrity – note the complexity – see the same history in different ways or I can say that the same story can be told one way or another. Those who have taken courses, even very basic ones, on non-Euclidean geometry can see how a theorem sometimes appears to be equal and sometimes has variations. And this is not a very difficult exercise.

I cannot resist the temptation to end with a little story. Many years ago Guillermo Páramo, a desk-bound anthropologist who did not interact directly with the indigenous communities but read exhaustively all the reports that could be obtained on certain cultures, reports written by field anthropologists, tried to order and translate indigenous knowledge into a form that would be understood in our context. For Guillermo Páramo, the Tucanos – indigenous of the Colombian Amazon – exist in a setting and time that is different from ours but that can be translated for our understanding, according to our academic tradition, using the Mobius strip as a model. A Mobius strip, as you know, is a surface that is obtained by taking a strip, giving it a half turn and affixing one end to the other. It is not a ring, it is a ring that has been given a half turn before closing it. On this surface locally there are two sides and globally there is only one. Locally the differentiations are key, any anthropologist will tell you so, oppositions, binary classifications, etc. The anaconda, the snake of the Tucanos, is integrated inside and outside. If you cut the snake lengthwise you get a Mobius strip. If you cut it crosswise, you get a strip, a Cartesian ring, with two clearly defined sides, locally and globally different. Tucano time-space has this structure this allows them to be locally consistent and globally inconsistent. Why am I telling you this ? Because someone like Páramo is a cultural amphibian, a desk-bound amphibian, because he places at society's disposal a certainly arbitrary version of what is seen in the Tucano cultural tradition. Now imagine a supremely polarized society that tries to adopt the Tucanos-Mobius strip model to say : confrontations are objectives, distinctions between what to do and what not to do are clear, thus positions assumed on a series of issues should be clear, however we must certainly recognize that in one sense these differences are local. And if you experience, as a cultural amphibian or through knowledge, the strip, you come out on what would seem to be the other side of the strip without having transferred from one side to the other. It took considerable effort for humanity to comprehend that what is locally flat is globally round.

[1] Bernstein, B. (1971-1990) Class, Codes and Control, Vol. I-IV, London: Routledge. Bernstein, B. (1995) Pedagogy, Symbolic Control and Identity: Theory, Research, Critique, London: Taylor & Francis.

Consideraciones introductivas

Antanas Mockus Sivickas

Puedo ver esta reunión como la reunión de una internacional, parecida a la que celebra Borges en su poema “Los Conjurados” : gente que decidió hace varios siglos creer en la discusión racional.

La parte de esa internacional aquí reunida viene trabajando sobre el arraigo de los académicos en cada país y sobre sus migraciones. Su trabajo pone además en tensión las grandes corrientes del pensamiento contemporáneo sobre la sociedad.

Algunos solo vemos o solo ven individuos. Otros prefieren o preferimos ver relaciones. Si miramos las migraciones desde estas dos perspectivas vemos cosas muy distintas : o individuos que se mueven de un lado a otro o relaciones que de algún modo se desgarran, se rompen, mientras que otras, incluso a veces previamente a la migración, se anudan o fortalecen. Se da así un proceso selectivo sobre las relaciones. Algo similar a lo que algunos de ustedes han estudiado según los resúmenes que he leído : una selección sobre las habilidades que operan en el nuevo contexto. Si uno deja de ver el movimiento del individuo y ve la migración como modificaciones en los tejidos sociales, en el lugar de arranque y en el de llegada, o como movimiento del conocimiento se pueden ver cosas muy interesantes.

El estudio de las migraciones enseña mucho sobre las sociedades. Hay un debate presente en las ponencias y tiene que ver mucho con la paradoja de este momento de la historia. Por un lado, sociedades que se asumen en el marco de una economía de mercado cada vez más internacionalizada y, por el otro, sociedades de conocimiento, sociedades donde el conocimiento es una fuente decisiva de productividad y de poder. Intentar ver las dos cosas al tiempo genera dificultades de lectura : mientras unos leen la circulación de conocimiento y de conocedores desde el paradigma de la circulación de mercancías, otros muestran que esa lectura es muy limitada.

Quiero entrar en la discusión en este punto y tratar de pensar primero en la circulación del conocimiento y luego en la circulación de conocedores. La circulación de conocimiento, a diferencia de la circulación de cosas, de bienes, requiere operaciones muy fuertes de selección y jerarquización y de adecuación, adaptación, del conocimiento para que éste arraigue en el nuevo contexto. Tomo conocimiento de un contexto y lo llevo a otro, pero al tomarlo tengo que seleccionar, no puedo llevarlo todo. Segundo, después de seleccionar, probablemente tengo que modificar las relaciones internas, jerárquicas, lógicas : lo que allá era corolario aquí puede ser teorema y lo que allí era teorema aquí puede ser corolario. Y después de esta reestructuración, en tercer lugar, este conocimiento, que ha sido separado de su contexto de origen, de los juegos de lenguaje, de las prácticas que lo acompañaban en el contexto de origen, tengo que ligarlo con las prácticas, los juegos de lenguaje que hay en el contexto de destino. Llevar conocimiento de un lado a otro resulta ser una operación mucho más compleja que llevar bienes materiales de un lado para otro.

La interacción entre quienes producen y crean conocimiento y quienes recontextualizan el conocimiento puede ser una interacción fértil. El esfuerzo de seleccionar, jerarquizar y adecuar a otro contexto, puede producir cambios incluso en el contexto de origen. Pero lo clave es que el conocimiento para circular tiene que ser deformado, readaptado, reestructurado o reconstruido. Y esto funciona en varios eslabones de tal modo que el proceso se repite varias veces y al final se tienen contenidos supremamente distintos de los que se tenían al origen. La física que sabe un graduado de bachillerato en Italia o en Colombia está muy alejada de la física de

los físicos, incluso de la física clásica de hace dos o tres siglos. La maravilla es que, a pesar de la deformación, parte de los que primero conocieron la versión más deformada van accediendo a versiones más cercanas de las fuentes y algunos llegan a poder interactuar solventemente con quienes están produciendo el conocimiento en la fuente. Aún más, nadie llega a producir conocimiento original genuino sin haber recorrido ese camino a través de versiones supremamente simplificadas, deformadas, adaptadas para que tengan sentido y utilidad en diversos contextos, casi siempre ajenos al contexto de producción del conocimiento.

Ya con reconocer esta estructura de reproducción del saber académico, simplemente mirando dentro de la misma sociedad distintos niveles del sistema, puede uno apreciar la enorme importancia de quienes pueden familiarizarse con y trabajar en, por lo menos, dos eslabones del proceso, de quienes pueden aprender y enseñar en dos contextos distintos, de quienes - por ejemplo - logran, aunque sea una sola vez en su vida, aportar en una discusión con aquellos que producen conocimiento original y al mismo tiempo se desempeñan en otros contextos. Tales individuos probablemente serán los mejores recontextualizadores.

Podemos imaginar una sociedad educativa dentro de 50 o 100 años en la cual el bien más preciado podrá ser una conversación o una lectura que reorganice los archivos mentales. Allí, la selección de qué puede ser pertinente, qué puede ser relevante, qué puede encontrar una relación fecunda con lo que la gente ya sabe, se va a volver decisiva porque va a definir qué puedo aportar yo y qué me puede aportar el otro. Una sociedad del conocimiento depende radicalmente de los procesos de recontextualización.

La circulación contemporánea del conocimiento, el funcionamiento mismo de la ciencia y la educación, requieren -si se nos permite un símil arriesgado-, de pequeñas “migraciones” : emigrar entre niveles de un sistema educativo, emigrar hasta las mejores universidades de un país o entre las buenas universidades del mundo, ir y regresar, poder participar fértilmente en la conversación en una y en la otra, teniendo la capacidad de adecuar, de traducir, de simplificar para alimentar un enriquecimiento del acervo disponible en cada uno de los eslabones. Localmente en uno y otro contexto los oídos deben estar abiertos y los vínculos deben funcionar adecuadamente. *Solo parcialmente quien recontextualiza es el recontextualizador*. Cómo lo han mostrado las investigaciones de Basil Bernstein en la Universidad de Londres [1], normalmente más que obra consciente de personas, la selección, jerarquización y adaptación – inserción de conocimiento en el nuevo contexto hacen parte de los mecanismos de reproducción de la sociedad. En buena parte son implícitos e involucran múltiples agencias estatales y privadas que forman y distribuyen conciencias e identidades. Se concluye algo obvio : más que emigrantes exitosos habría migraciones exitosas.

Si se quieren subrayar los retos que la diversidad cultural interna de las sociedades y la diversidad cultural entre sociedades le plantean a la circulación de conocimiento, cabe intentar ver al recontextualizador como a un *anfibio cultural* y preguntarse por las condiciones en las cuales las sociedades acogen y aprovechan a ese anfibio.

¿Qué es un anfibio cultural ? A primera vista parece un camaleón. Obedece el “donde fueres has lo que vieres”, la conocida moral provisional de Renato Descartes. Pero si solo se adaptara no funcionaría como un vector, como un transportador selectivo del conocimiento. El anfibio cultural aprende distintos juegos, se inserta en distintos sistemas de prácticas y al mismo tiempo asegura un transporte selectivo de fragmentos de conocimiento. Dos son los grandes retos que enfrenta : calidad de la recontextualización, integridad.

La circulación de conocimiento solo es posible si hay recontextualización (selección, jerarquización, adaptación). Pensemos ahora las migraciones como recontextualización. Una mezcla de conocedores y conocimientos. Primero pensemos en el movimiento de la gente como recontextualización de gente. Entonces pensemos en que el acervo de conocimientos de cada persona y por decirlo de alguna manera sus vínculos, sus nexos sufren una reestructuración muy

fuerte en el momento en que cambian de contexto. Algunos lazos se anulan o se debilitan, otros lazos se crean o fortalecen. ¿Quién jerarquiza, quién adapta, quién escoge qué habilidades serán las que serán más útiles en el nuevo contexto, crecerán más en él, qué cosas se volverán más disponibles, qué cosas quedarán más en la sombra ? ¿Al mismo tiempo qué hace que las tradiciones culturales se abran en mayor o menor grado, y de manera más o menos consciente, para aceptar a estos interlocutores que en algún momento resultan portadores "externos" de lo más propio de cada tradición ? Es muy difícil de desagregar, pero uno podría decir que el mercado influye sobre eso, pero que no lo determina todo.

¿Cuál es la diferencia entre un anfibio cultural y un emigrante ? Probablemente todo emigrante en algún momento de la vida se ve tentado por la opción de anfibio cultural. Simplificando mucho, alguien puede ver su migración como una especie de rito de iniciación en una nueva cultura. Y algunos de nosotros, al vernos iniciados en una nueva cultura, decimos "un momento ¿será esto reversible ?". Cualquiera que haya estudiado antropología sabe que no es reversible. Entonces cambio la pregunta : ¿será entonces que yo puedo recorrer este túnel de iniciación para volver a la cultura de origen, para volver a entroncar, para volver a conversar con los que me rodearon o rodearon mi mundo en otro momento ? La respuesta es : tal vez sí, pero en ese momento, si usted puede circular libremente entre dos mundos distintos, usted está abocado a la pregunta de si puede usted pertenecer en un sentido muy fuerte a dos tradiciones culturales distintas. No sé si la respuesta sea afirmativa, pero es muy interesante explorar esa posibilidad. Se parece mucho a la pregunta aún más radical de si cabe concebir un anfibio religioso.

La modernidad diferenció cultura, moral y ley, llevando hasta sus últimas consecuencias caminos abiertos en Grecia. De algún modo Diógenes enseñó con sus acciones que la moral está por encima de la cultura y Sócrates ilustró con su propia muerte la tensión entre compromiso moral y ley. Sócrates aceptaba que por razones morales se podía desobedecer la ley. Pero sin pretender por ello evadir las consecuencias de esa desobediencia. Los legisladores y los jueces escuchan, pero una vez generada y aplicada la norma, la persona debe respetar el orden de su sociedad. Si no pude persuadir oportunamente a mi sociedad de que hice lo justo, la sociedad me puede castigar y debo acatar su decisión. Algunos autores resumen esto en "si usted no puede persuadir, tiene que obedecer". Así, la tensión entre la constitución del individuo y el respeto al orden social está allá desde el comienzo.

En el caso del anfibio, la tensión es mucho más violenta : ya no es mi individualidad frente a mi sociedad sino mi individualidad frente a dos sociedades, dos mundos como marco de referencia. Y el anfibio, además de respetar activamente dos culturas distintas, es responsable de algún modo por sus vínculos y por la circulación, aunque sea selectiva, de conocimientos entre la una y la otra.

Bueno, soy consciente de que al plantear el tema del anfibio vuelvo a mirar las cosas desde el paradigma del individuo. Aún así, ayuda a abordar todo lo que está en juego cuando aparentemente hay un movimiento de un individuo de un lado a otro.

Los movimientos de personas y de conocimientos ayudaron a separar la cultura de la moral, caso muy claro de Diógenes, y a separar la moral de la ley, caso muy claro de Sócrates. Probablemente en la mayoría de las sociedades contemporáneas esa separación es bastante fuerte, las reglas morales son reglas que generalmente están referidas al individuo y de algún modo el mensaje permanente de la sociedad es que cada individuo debe construirse su moral. Grandes pensadores de la moral como Kant han llegado al punto de decir "puedes ponerte tu mismo tus reglas, lo único es que obedezcas una meta-regla, a una regla de reglas : sigue reglas que puedas querer que los demás sigan)". Hay todo un desarrollo autónomo o aparentemente autónomo de la moral. También regulan los comportamientos las costumbres (y hay claramente sociedades que son tolerantes de la diversidad de costumbres y de creencias) y el sistema jurídico que consiste en leyes explícitas, sanciones explícitamente previstas, autoridades explícitamente previstas para aplicar las sanciones, procedimientos explícitos para aplicar las

sanciones. La moral sanciona con malestar o con culpa, la cultura sanciona con exclusión, con censura, con rechazo. La cultura trata de movilizar sentimientos de vergüenza y la ley moviliza sanciones explícitas como cárcel, detención, multas.

Se trata pues de tres sistemas reguladores que funcionan con relativa independencia. En general la moral es más exigente que la cultura, la cultura es más exigente que la ley, sólo hay que aplicar la ley cuando fallan las barreras de la moral, o fallan las barreras de la cultura. Unos pocos individuos son disuadidos por el temor a las sanciones legales, la mayoría de los individuos son regulados y disuadidos por la moral individual y por las reglas culturales de su comunidad de referencia.

Vuelvo al anfibio cultural. El anfibio cultural tiene que estar elaborando su moral para poder, desde su moral, relacionarse con dos tradiciones culturales distintas, con dos sistemas de reglas culturales distintos. Cuando se mira la historia de las religiones y de la lucha entre las religiones, se ve que religiones rivales fijaban reglas que claramente no podían cumplirse al tiempo. Entonces el anfibio religioso tiene que privatizar parte de su práctica religiosa, no puede aparecer el sábado en la sinagoga y el domingo en la iglesia. Los ritos religiosos de algún modo ligan el mundo más interno, el mundo moral, con el mundo externo.

¿Contribuyen las migraciones a generar anfibios culturales o algunos de los emigrantes conservan lazos tan fuertes con su origen que podrían verse atrapados en este tipo de problema ? Creo que la respuesta es sí, aunque no estoy seguro que sean todos. Es posible que en algún momento se cambie simplemente de la pertenencia a una cultura a la pertenencia a otra cultura. Algunas de las discusiones que adelantan ustedes apuntan al reto de lograr lo que podríamos llamar la doble pertenencia. Esa experiencia todavía tan precaria, tan artesanal, que es la Red Caldas (que va a ser objeto de análisis en este evento) busca hacer que los investigadores colombianos que están en otra parte sigan siendo de aquí y que dediquen parte de su energía, parte de su tiempo, a conservar a Colombia como uno de sus marcos vitales. Consiste básicamente en una lista de correo a través de las cuales los investigadores colombianos se comunican entre sí. Utiliza la tecnología para tratar de mantener unos vínculos, entre ellos y con su cultura de origen. Parte de esta cultura de origen se expresa en que la red es utilizada más para cosas culturalmente válidas desde su ámbito que para la discusión científica. Este pequeño refugio para el emigrante evidentemente no soslaya otros usos posibles.

Muchas de nuestras sociedades ganarían enormemente si lograran que sus científicos en el exterior se comprendieran a sí mismos como anfibios culturales. Algo hoy muy facilitado por los avances en comunicaciones y transporte : cada vez es más fácil que el que se ha ido vuelva aunque sea por unos días. El efecto de esa circulación sobre los lazos que lo rodean y el efecto de esa circulación sobre las habilidades que él tiene, sobre el uso de esas habilidades, sobre el uso selectivo de esas habilidades me parece un tema apasionante.

Quiero ahora referirme a la relación de esto con la situación colombiana. En Colombia muchos comportamiento ilegales son culturalmente aceptables. Es posible que en algún grado, por lo general menor, en muchos países latinoamericanos suceda algo similar. La misma fuerza que ha cobrado la economía llamada informal demuestra que de algún modo es funcional para el sistema que no todo el mundo esté dentro de la ley y eso quiere decir que culturalmente se generan ámbitos en los cuales es aceptable lo no legal y probablemente algunos casos lo inmoral. Entonces se tiene en la población común y corriente una tensión grande que va a ser parecida a la del anfibio cultural. Personas que saben que la ley fija este límite, que moralmente probablemente ven el valor y la justificación de la ley y sin embargo son fuertemente inducidas por su contexto cultural a seguir unas reglas culturales en disonancia con sus reglas morales y sus reglas jurídicas. Mucha gente puede sufrir así la tensión entre su identidad moral, su marco de leyes nacionales y sus prácticas. Entonces mucha gente puede verse expuesta a la obediencia simultánea de varios sistemas de reglas. Las tensiones que sufre el científico emigrante pueden ser parecidas a las del ciudadano en estas situaciones de divorcio entre ley, moral y cultura.

Las migraciones científicas nos pueden ayudar a visualizar, como un caso de laboratorio y con un nivel de autoconciencia particularmente alto, tensiones que son muy frecuentes en la vida interna de nuestras sociedades. Las migraciones dentro de una sociedad como la nuestra significan en muchos casos un trasplante tan complejo como el trasplante de un científico de un lado a otro. ¿Cuál es la diferencia en esa comparación ? Que de algún modo u otro los que hemos tenido una cierta iniciación en la cultura académica creemos que pertenecemos a una comunidad generalizada de dimensión internacional. Hasta cierto punto es una ficción lo de las comunidades científicas internacionales pero también tiene una cierta realidad : las publicaciones, la comunicación, el intercambio y sobre todo una realidad que es la ilustración, dentro de ese grupo, de la fuerza de la comunicación honrada. Simplificando mucho, la comunidad científica es la ilustración de una humanidad que interactúa sobre la base del reconocimiento honrado de razones. Entonces tenemos gente, alguna que pertenece a dos culturas, otra que pertenece a una sola y que sin embargo adelantan una empresa común. También cabe leer que cada uno o cada nación adelanta su propia empresa pero necesita de la interacción honrada con los demás, con los distintos. De cualquiera de los dos modos la comunicación honrada es un fundamento del trabajo de las comunidades científicas internacionales. ¿Qué pueden aprender las sociedades de esa comunidad científica internacional ? Que la diversidad cultural podría ser asumida a fondo, no con mera tolerancia – por favor existan y piensen distinto – sino administrando la riqueza viva del intercambio entre tradiciones distintas y entre grupos culturalmente muy diferenciados. ¿Qué puede aprender la gente de las migraciones científicas y de ciertos elementos de la estructura básica de la comunidad científica internacional ? Puede aprender algo muy raro : por un lado *la confianza en la comunicación honrada*, entendiendo que la comunicación honrada no es automática, que siempre hay problemas de traducción, que siempre lo que digo puede ser escuchado de una manera muy distinta a como yo lo entiendo ; y, por otro lado, *la conciencia de la arbitrariedad y complejidad de las traducciones*. En la interfaz entre tradiciones culturales distintas, vuelve a ser crucial para que la diversidad cultural sea posible y además sea fértil, la selección, la jerarquización y la apropiación selectiva de conocimientos. De algún modo necesitamos anfibios culturales altamente responsables y los emigrantes científicos son apenas una fuente posible y privilegiada de ellos.

Bogotá, la ciudad que nos acoge, es una ciudad muy curiosa, es una ciudad cuyo nombre se escribe de dos maneras en los periódicos : unos lo escriben Santafé en una sola palabra y otros Santa Fe separado. La bandera de Bogotá se ve mucho en la ciudad, pero no colgada sino pintada en los escaparates y en los pequeños vehículos de los vendedores informales. Además el mapa de la ciudad se dibuja a veces con el norte par arriba, a veces con el norte a la izquierda, y también a veces con el norte a la derecha. Es una ciudad que en cierto sentido sabe que las convenciones son convenciones, pero que muchas veces se olvida que las convenciones tienen que ser universales para que funcionen. Esas características raras de la ciudad parecen corresponder a una ciudad de emigrantes. Ilustran bien las limitaciones en lo que podría ser la fertilidad de los intercambios. Si las convenciones fueran mas compartidas, si hubiera algo más de reglas comunes, sería una ciudad más fértil. Si decimos reglas comunes viene el problema de las reglas de quién, probablemente ninguna de las tradiciones presentes quiere aceptar que otros grupos impongan sus reglas o sus tradiciones.

Aunque ley, moral y cultura se diferencian irremediablemente en las sociedades actuales, hay autores que subrayan sus relaciones. Rawls, por ejemplo, dice que una misma ley puede ser apoyada desde distintas tradiciones culturales y que debe ser así para que esa ley funcione. Hay autores como Durkheim y MacIntyre que dicen que la indagación moral individual cortada de tradiciones culturales es suicida, porque es un proceso autodisolvente. Empíricamente hay sociedades en las cuales pagamos un precio muy alto, en Colombia 26.000 muertes al año, por el divorcio entre lo culturalmente aceptable y lo legal y moralmente aceptable. Ley, moral y cultura se han diferenciado, pero en algunos casos además regulan en direcciones distintas el comportamiento humano y entonces pueden ser claves personas capaces de respetar no lo

superficial sino los elementos más profundos de dos o más tradiciones culturales. Es posible que las sociedades en su crecimiento hayan tenido que ir generando ese tipo de alternativa, de híbridos, de personas que pueden de algún modo garantizar la interacción fértil entre sociedades distintas o entre grupos socioculturales fuertemente diferenciados dentro de la misma sociedad. ¿Es eso compatible con la comunicación honrada, franca permanente ? Maquiavelo colocaba en alto valor la mentira : el precio de la articulación de distintos actores sociales en algunos casos es obviamente o el secreto o incluso la mentira. Si uno trata de trasladar la experiencia de convivencia interna de tradiciones distintas que tienen las comunidades académicas a sociedades tan complejas como las nuestras, uno puede sentirse tentado por la pregunta de qué pasaría si se hiciera un esfuerzo honrado de traducción, qué pasaría si hubiera sinceridad permanente. Los riesgos de fracaso son altísimos, pero el proceso puede ser supremamente interesante.

Hay una manera aún más crítica de verlo y es considerar que la confianza en la comunicación honrada es total ingenuidad. Aún así cabe responder que en algunos casos la sociedad tiene que acudir a la ingenuidad como única alternativa para reducir el cinismo. Recuerdo una película soviética, dónde después de una serie de asesinatos de alcaldes en un pueblo que estaba en disputa en los años 50, decidieron elegir al bobo del pueblo como alcalde porque no tenía enemigos. Probablemente entre el bobo del pueblo y el anfibio cultural hay un espectro bastante amplio de posibilidades que quisiéramos evaluar.

Me disculpo por las referencias locales que me he permitido en este evento internacional. Ustedes van a discutir los problemas en su universalidad y en su generalidad. Si me he referido un poco a la circunstancia colombiana, es para explicarles mejor el entusiasmo con el cual acogemos gente como ustedes y un evento como éste, como fuente de conciencia, como fuente de comprensión.

Tal vez, en el futuro se compare en Colombia el paradigma de la negociación con el paradigma de la traducción. Y al lado de los manuales de Harvard sobre cómo negociar sin ceder, cómo precisar y sacar adelante objetivos, etc., aparecerán investigaciones sobre “cómo es tu versión y déjame ver si logro traducirla hasta que sea compatible con mi versión”. Ayuda el que ya no haya el gran relato, la gran utopía histórica que pretendía darle a todo el mundo su lugar. Contribuye a reconocer los puntos comunes de relatos menos ambiciosos. Y sirve mucho que ya casi nadie esgrima el gran relato para callar a los demás. Ahora hay intercambio entre relatos modestos, hay traducciones y de algún modo se puede ir descubriendo la compatibilidad local entre distintos relatos. La autorepresentación de distintos actores en conflicto puede ser tan importante como el logro de resultados. Mucha gente cedería en los resultados si simplemente tuviera un lugar en la lectura que unos y otros hacen de su visión y acción. De nuevo, la coexistencia de distintos relatos vuelve a tener una estructura lógica muy parecida a la del anfibio cultural : puedo, sin sufrir en mi integridad moral – fíjense lo complejo –, leer una misma historia de distintas maneras o puedo decir que lo mismo puede ser contado de una y otra manera. Quienes han tomado cursos, aún elementales, de geometrías no euclídeas pueden ver cómo un teorema figura a veces igual, a veces con variaciones, en una y otra. Y no se trata de un ejercicio demasiado difícil.

No resisto la tentación de terminar con una pequeña historia. Guillermo Páramo, hace muchos años antropólogo de escritorio, no interactúa directamente con las comunidades indígenas pero lee minuciosamente todos los informes que consigue sobre ciertas culturas, informes realizados por los antropólogos de campo, y con eso trata de ordenar y traducir conocimiento indígena de una manera que pueda ser comprensible en nuestro universo. Para Guillermo Páramo, los Tucanos – indígenas de la Amazonía colombiana – tienen un espacio y un tiempo distinto al nuestro que puede traducirse a nuestra razón, a nuestra tradición académica, usando como modelo la cinta de Möbius. La cinta de Möbius, ustedes la conocen, es una superficie que se obtiene tomando una cinta y dándole un giro de media vuelta a una de las puntas y pegándola con la otra. No es un anillo, es como un anillo al que se le ha dado media vuelta antes de cer-

rarlo. En esta superficie localmente hay dos caras y globalmente hay una sola. Localmente las diferenciaciones son claves, cualquier antropólogo lo dirá, las oposiciones, las clasificaciones binarias, etc. La Anaconda, la serpiente de los Tucanos, tiene un adentro y un afuera que se integran. Si uno corta la culebra a lo largo, obtiene una cinta de Möbius. Si la corta a lo ancho, obtiene una cinta, un anillo más cartesiano, con dos caras claramente definidas, local y globalmente distintas. Si el espacio-tiempo de los Tucanos tiene esa estructura, eso les permite a ellos ser localmente consistentes y globalmente inconsistentes. Les hablo de esto ¿por qué ? Porque alguien como Páramo es un anfibio cultural, de pronto de escritorio, porque pone a disposición de la sociedad, una versión seguramente algo arbitraria de lo disponible en la tradición cultural Tucana. Ahora imagínense ustedes una sociedad supremamente polarizada que intenta tomar de los Tucanos el modelo de la cinta de Möbius para decir : las confrontaciones son objetivas, las diferencias entre qué se debe hacer y qué no se debe hacer son nítidas, las tomas de posición sobre una serie de temas deben ser claras y, sin embargo, nos corresponde reconocer que en un sentido muy fuerte esas diferencias son locales. Y tal vez si usted recorre, vía experiencia de anfibio cultural o vía conocimiento, la cinta, usted sale a lo que parecía ser la otra cara de la cinta sin haber cambiado de cara. A la humanidad le costó mucho trabajo entender que lo que era localmente plano era globalmente esférico.

[1] Bernstein, B. (1971-1990) Class, Codes and Control, Vol. I-IV, London : Routledge. Bernstein, B. (1995) Pedagogy, Symbolic Control and Identity : Theory, Research,

Historical and Conceptual Framework

Part 1

Policies and Programmes on Qualified Human Resources Migrations

Lelio Mármora

The conceptual implications of the term “brain drain” and its relations with migration processes

Migration of scientists is part of the present international movement of HQR, and can include professionals, technicians, executives and businessmen. While each has its specific particularity, they conform a relatively homogenous migration group with regard to causes, effects and possible institutional responses.

The analysis of this major category of human movements gives a global approach to the problem, and allows for some hypotheses on the subject. This does not mean a disregard for the specific nature of the migrant scientist, but rather an attempt to understand him within his context and then extract elements to study him individually.

Analysts stress the increase in migration of skilled human resources in recent decades (Salt, 1983 ; Findlay, 1990 ; Appleyard, 1991 ; Ghosh, 1992), as well as the relatively short duration of such migrations (Salt & Singleton, 1995).

There is also consensus that growing migration has different explanations, ranging from the macroeconomic relations of countries to the psycho-social situation of the migrant (Portes, 1976).

The macroeconomic explanation is that globalized production, with the subsequent growth of transnational firms (Sassen, 1988), economic growth in some developing countries with a lack of skilled human resources have increased migration (Findlay, 1990). Modern economy has changed production organization and this also influences growing migration (Tachiki, 1990), as has means of rapid transport which allow executives and technicians to make short trips (Salt & Singleton, 1995).

In political terms, the selective restriction policies - open for certain types of qualified migrants - adopted by the host countries in recent decades have been of special importance (Appleyard, 1991), as have specific events of major world impact such as the political collapse of the ex-socialist regimes (Barnathan, 1991 ; Schkolnikov, 1992).

Furthermore, it is clear that while the global economy and other factors mentioned, form the base of this growing QHR movement, there are other contributing, and in some cases determining, causes, such as global culturization. Cultural trans-nationalization offers, for certain skilled strata, a common base allowing them to migrate and establish themselves abroad without need for “ culturization ”. They can live in new societies without integrating themselves as was the case of migrants at the beginning of the century, but not for this reason are they marginal. They interact with members of the host society, and other migrants with similar cultural backgrounds, not because they belong to an ethnic or national group, but because of their socio-economic and labor status.

They move in a world of transnational standards, where they perceive national culture as an item of folklore. Their children go to special schools where standards are the same worldwide.

They make no effort to integrate with the host society because they know their stay is temporary. And perhaps what is most important, their labor and social protection depend far more on the transnational company for whom they work than on the country to which they belong. Executives, specialized technicians, experts, consultants of all types, make up this new and growing mobile population which questions the very concept of migration.

These population movements have features which distinguish them from the classic concept of migration. They are far less visible than the mass migrations, since they move in spaces both closed and international. Their movement is programmed mainly by the corporate policies of the entities for which they work, while the influence of State policy in promoting or regulating their movement is questionable. They are, simultaneously, the product of the economic restructuring of post-industrial society and net exponents of the accompanying transnational culture.

The increase in this type of migration, its special composition and rapid and often short-lived movement, have generated differing interpretations, not only on this particular phenomenon but on the very concept of future movements (Zolberg, 1989).

The first point to be explained is that while these migrations have increased, they continue to represent a small portion of migration movements worldwide, and their importance owes more to quality than quantity.

In this sense, generalizations on migration changes in general are questionable if they only use the changes observed in this segment. Furthermore, a more in-depth study is needed of two conceptual problems on this subject :

First, there is the current relevance of “ migration ” and, second, the conceptual validity of the “ brain drain ”.

Regarding the first, greater QHR mobility and shorter duration has drawn attention to the need to restate the “ traditional ” conception of migration. That is, the permanent migrant, moving with family to settle permanently, possibly thinking in the mass movements at the beginning of this century. In this context, the present QHR migrations should be analyzed as short-term population “ movements ”.

The fact is that there have always been temporary labor migrations, such as the large-scale “ swallow ” migrations at the beginning of the century. What is new is the growing tendency for temporary migration of skilled personnel ; but this alone is not sufficient to modify the concept of migration. Nevertheless, a more precise definition may help to avoid confusion on what we are really trying to describe or explain.

In this sense, it is important to have a definition on what is considered as “ human migration ”. If definition is spacial, we are left with the doubt as to what is the minimum distance needed to classify a person as a migrant. Geographical borders ? The distance involved ? If definition is time, we are faced with arbitrary definitions on the term migrant. To what extent is someone making a short-term move to work elsewhere considered a migrant ? What is the measurement unit to distinguish the different types of migrations ? To what extent do the categories “ permanent ” or “ temporary ” include totally different migratory movements ? (Price, 1989). If the definition is labor, what happens to retired or unemployed migrants ? Based on these restrictions, a definition is proposed which combines the fact of moving in the spacial sense with a socio-cultural change, in function of “ reproducing the daily existence of a person...” (Mármora, 1989).

Migration implies settling in a different place from the previous residence, and where the person engages in the relations which constitute his socio-economic life. Tourism is not migration, because the purpose is not to settle down and recreate the social, cultural and labor environment, but that of recreation and rest.

Another problem is the validity of the concept “ brain drain ”, in view of the present international mobility of QHR. The term “ Brain Drain ”, as defined in 1962 by the British Royal Society

in a report on the emigration of scientists and technicians from this country towards the United States (IMO, 1990) is considered as negative for the countries of origin from the 60s onwards.

In order to extend the definition to all skilled personnel, as of the 70s the phenomenon is referred to as " exodus of qualifications ". In 1972, at the Third Meeting of the United Nations Conference on Commerce and Development, it was defined as a problem of " reverse transfer of technology " (RTT). In this context, the loss for the developing countries represented by the emigration of their most skilled human resources is acknowledged, as is the contradiction existing between this reverse transfer of technology and the efforts of the international community to accelerate development in the countries affected by this negative flow (IMO, 1990). " Human Capital " theories provide the framework for this position, and consider the emigration of skilled personnel from undeveloped to industrialized countries as proof of the asymmetric relations between them (Fernandez Lamarra, 1922).

In the 70s, UNCTAD sponsored studies in countries such as India, Philippines, Sri Lanka and Pakistan (Logan, 1992). Other entities deal with the same subject in other regions, such as Latin America (Oteiza, 1965 ; Ozlak and Caputo, 1973 ; Sanchez Crespo, 1969 ; Gutierrezz Oliva and Perez Riequelme, 1965).

Given the circulatory nature of these movements of highly skilled labor, some authors have proposed the term " exchange of qualifications " as being more suitable than " brain drain " (Findlay, 1990). The problem with this type of definition is the meanings contained therein. " Brain drain " presumes a loss of human capacity for the country of origin, while the interpretation of " exodus of qualifications " is more general, covering those with different technical aptitudes (Boussaid, 1994) ; the notion of " reverse transfer of technology " implies a relationship where the less-developed party loses and the relatively more developed party wins ; " exchange of skills " would refer to a kind of international labor distribution of QHR ruled by demand, regardless of different levels among the parties involved. It is probable that these terms are suitable to define phenomena co-existing now, rather than those predominating at different stages.

Thus, brain drain explains the emigration of QHR from one place to another. That is, from one industrialized country to another, as well as from developing countries to industrialized countries. Permanent migration is implicit in the definition. This type of population movement continues and is growing significantly. For example, taking statistics per year of entry of foreigners living in the United States, it is noted that 7.5 % of the migrants entering prior to 1990 were professionals, this percentage increased to 11.4 % for 1990-94, such migrants came industrialized and non-industrialized countries (Hansen K. and Bachu A, 1995).

Within the context of " brain drain ", the " reverse transfer of technology " continues to exist, as can be seen by the fact that from 1961-83 at least 700,000 scientists, doctors, and other highly qualified persons emigrated from developing countries to the United States, Canada and Australia (Stalker, 1994).

And finally, the " exodus of qualifications " or, in its more dynamic form " exchange of skills ", has multiplied in recent decades as another type of temporary migration, sometimes short-term. It preferably exists between industrialized countries or from the latter to developing countries, frequently within the framework of multinational productive structures, or technical cooperation for development. In recent years, there has been an increase in the so-called horizontal technical cooperation between industrialized countries (TCIC).

Today, we are faced with different migratory patterns for QHR. All QHR movements have increased in recent years without this meaning that some have replaced others.

This reality raises some questions, such as, if temporary migrations between industrialized countries could mean a reduction in reverse transfer of technology. This assumption considers the possibility that extending the labor market from national to regional areas, the temporary

location of QHR in such area would absorb excess offer without the person having to leave the country of origin permanently. This has been one of the arguments of supporters of TCIC. While there is no empiric evidence to check this hypothesis, so far nobody has said that in the medium-term this is not a possibility for retaining QHR. But in practice, temporary movements in the form of TCIC are not directed at better income or generating employment, but the " exchange of qualifications " between countries having a similar degree of development.

Cost-benefit of QHR migration

Faced with growing QHR migration in its different forms, different public and private policies have been put in place to define them, and discussion has centered on the cost-benefit analysis. Different programs have been proposed and performed in execution of these policies.

First, we must ask who makes the policies. Tradition assigns this duty to the States which promote, restrict or regulate migration, while the private sector exerts pressure, accepts or uses such policies for its own benefit. Growing QHR migrations would appear to indicate that the private sector role in some cases - like that of the transnationals - would have a decisive incidence on the direction and characteristics of these flows (Salt and Singleton, 1995). Nevertheless, it is clear that the institutional responses of States play the main role in this subject, but sharing this task more and more with other economic and social sectors.

The cost-benefit analysis is the foundation of policies on this subject. Policy objectives will depend on this analysis. In the case of public policies, the cost-benefit of the brain drain, particularly when this means reverse transfer of technology has been analyzed in different ways, depending on its impact on the country of origin and that of arrival.

For the country of origin there are positive and negative positions regarding these effects. There are those who favor emigration arguing that it reduces unemployment and sub-employment in the expelling country (Parodi, 1970 ; Polyzos, 1970 ; Maletta, 1988), those referring to the economic circuit of the expelling country, due to the incidence of remittances (Papademetriu, 1962). In the latter case, we can mention the advantage of the remittances for the families of the migrants, and this is reflected in the global development of the countries of origin (Purcell 1992 ; Murillo, 1979).

On the other hand, those who question exodus of qualifications, refer to the social costs of reproduction lost by the expelling country via this migration, as well as exclusion of the best qualified persons having leadership qualities needed for development (Thales De Azecedo, 1968 ; SIJL, 1971 ; Logan, 1992 ; Fernandez Lamarra, 1992). In the second perspective, we may mention those analysts who see the population loss as reducing consumption possibilities in countries whose development lies partly in activating the domestic market (Singer, 1971).

In this perspective, there have been several attempts to quantify the cost represented by this type of emigration for the developing countries. Thus, a Canadian estimate says the Third World countries will have contributed 10 billion dollars for this concept in 25 years, and in Hong Kong migrating graduates between 1987-89 represent 74,400 years of university teaching (Salt 1994). Thus, the cost of emigrated human capital appears as a transfer made by the developing countries, and the reproduction and training cost of said capital can be quantified.

Another cost is that of the social impact caused by lack of certain qualified personnel, necessary for the welfare of society, as for example that represented by the massive emigration of doctors and health care personnel (Boussaid, 1994). The mentioned authors include another cost ; QHR migrations delay technological progress in developing countries. This drain erodes

the very base needed by the country for its own economic progress. All these arguments have been questioned by authors stating the need to take the marginal rather than " average costs " of a graduate when calculating educational expense. That is, the increase in the university budget for each new student to be added to the existing enrollment list (Maletta, 1988).

It is also pointed out that, even if many of these young people were not to study, they would be equally unable to work due to the high rate of juvenile unemployment in these countries. In the case of the graduates, there would be a structural imbalance between the production of labor and the effective demand therefor. The former would be disproportionate with regard to the second (Maletta 1988).

Two comments may be made here : The first, that the demand for QHR established by the market does not necessarily correspond to society's need for such resources. That is, even when a market does not generate job, this does not mean that society does not need this professional. In this case, the educational structures are not over-dimensioned because they produce more professionals than needed, but that the markets are under-dimensioned with regard to the needs of society in general, since they are not generating the service demand needed by society for effective human development, and the QHR essential for economic development.

In this way, faced with the " escape valve " interpretation that pre-supposes the cost implied by an excess of qualified personnel which the market is unable to absorb, there is an opposing position. This considers that QHR are essential for development even when initially their production does not meet labor demand. In this sense, the results of an econometric study made in Southeast Asia by the Overseas Council of Washington (Fishlow, 1994) are conclusive. This study shows that previous education levels, and income and land distribution structure, explained more than 50 % of a country's growth rate. The " launching pad " role performed by the existence of QHR, is clearly evident in countries like Korea, Taiwan, Malaysia and Thailand, where 90 % of their growth is attributed to high education and equality levels existing prior to 1960 (Calcagno and Calcagno, 1995 P. 221-222).

The difference between " labor social structure " and " labor market " and their different combinations in terms of needs and availability, on one hand, and supply and demand, on the other, provide another key element for analyzing the cost of QHR emigration : that of *shortage* (Lepore, Gurriere, and Mármora 1984). The structural shortage of QHR occurs when " availability " cannot meet society's needs therefor. The shortage is expressed in the imbalance generated by unsatisfied demand.

The different situations analyzed, both from the position of the structure of society and the circumstances of the labor market, serve to uphold a first basic premise : that fact that there is no labor market shortage for a specific QHR, does not mean that society does not need such resource. This consideration is of the utmost important, since it can lead to totally different conclusions regarding the causes and effects of QHR emigration in the countries of origin.

If the analysis is limited to market logic and laws, the simple fact that there is no demand for QHR in the labor market would imply that such is not needed in a given society and, therefore, its exit would not harm the country of origin, but would rather be beneficial in labor market terms.

This final view, known as the " escape valve " has been accepted by some interpretations, considering that QHR emigration is a means of circulating human capital, making a more efficient assignment of human resources worldwide (JOHNSON, H. 1968 ; GRUBEL H. 1966) ; or that it helps regulate over-supply and under-demand in a national labor market, this being considered an advantage in some situations by providing better profits for those remaining in the country (SIJL, 1971). This analytic framework would remove any possible consideration on the true need a specific society might have for these QHR, masking in some way, the imperfections of the labor market and its relationship to the social structure wherein it operates.

Considering these elements, there are four situations related to the shortage of QHR (Lepore, Gurrieri and Mármora, 1984).

1. Structural shortage. QHR are needed but not available.

2. Demand shortage : QHR are needed and available but there is no demand.

3. Supply shortage : QHR are needed, available and in demand, but there is no supply.

4.Quality supply shortage : There is need, demand and supply but no availability.

The first form of QHR shortage, typical of developing societies is " structural ".

Here the major emigration cost is that of removing QHR from the country of origin where there are needed for socio-economic development. In this case, it is important to consider the so-called " reproduction cost " of the QHR (Harbison F. and Myers C, 1961), since this capacity is a key variant for interpreting the true effect on the country of origin caused by these migrations. This variant would constitute a more dynamic approach to estimating the effect of emigration than that of comparing the volume of QHR emigration with availability thereof (Kidd, Ch. 1970 ; Chaparro, F. 1971).

A second type of shortage is that of " demand ". Its effects are reflected in one of the components of QHR expulsion. This is not because there is an excess with respect to the needs of society but, as seen above, because the social structure lack mechanisms to generate the corresponding demand. This situation called " structural tension " by some authors (Sito N. and Stuhlman L. 1968) would imply that this type of emigration is more the result of the imbalance between a country's capacity to produce and absorb QHR, rather than poverty and underdevelopment. (Sassen-Koob S. 1978).

A third type of QHR shortage is " shortage of supply ". Here demand and availability exist but the professionals and technicians able to cover same are not interested, thus generating a migratory current. The indiscriminate import of models and techniques from industrialized countries deforms the education given QHR in developing countries. These imports carry an ideological, cultural and political message, and explicitly promote certain technologies and instruments, producing a secondary consequence, that of portraying a life style and professional practice which motivates the QHR to migrate.

On the other hand, these effects are more significant in economies, or stages of economy, of the developing countries where growth is " outgoing " and based on an export economy ; this stimulates migration of skilled and unskilled workers (Portes, 1982).

This latter form of shortage - in the countries of origin - is more serious than the other two, because the QHR migrating because of dissatisfaction with demand will be difficult to replace in the country of origin (Sassen-Koob S., 1978). Furthermore, it produces a drop in current economic activity and, worse still, reduces the short-term possibilities of reactivating this activity. Finally, this type of QHR migrant is less likely to return than those migrating simply for lack of demand, because the former leaves with the intent of settling down permanently. Their decision is based not only on dissatisfaction with possibilities in the country of origin, but also on prospects of the labor market and cultural and social framework in the destination country. For these reasons, their decision is more final than circumstantial, particularly when migration is towards a country with a better quality of life, where the QHR and his family may integrate themselves to better working and social conditions than in the country of origin.

Another type of shortage is " quality supply ", understood as unsuitable availability for existing QHR demand, it is determined by two parallel factors :

First, as already mentioned, QHR training is unsuitable, being directed more by its own dynamism than labor market demands and needs.

Secondly, it can be said that at a specific point, QHR migration which is selective, will deprive the market of QHR sectors that are difficult to replace. An example of this situation is the Colombian case, where despite significant QHR availability and supply without demand (Torales, 1980), in areas such as the Aburra valley or the Cali paper industry, the emigration of technicians at one time created serious problems.

Private sector considerations mean transferring this type of personnel, together with the production facility, to areas where salaries are low, and where there is a lack of highly qualified human resources (Tachiki, 1990 ; Findlay, 1990). Likewise, firms operating in high-technology areas will experience a significant need to mobilize their technicians and scientific teams, to sustain the information flow on recent changes (Salt & Findlay, 1989). Nevertheless, despite the need and advantages of these QHR transfers, and growth in such mobility, recent studies on multinationals shows that in regions such as Europe, only 0.65 % of the total workforce of these companies are expatriates (Brewster, 1988). Also there are problems in transferring corporate technicians from one country to another, and problems arise in handling people from different cultures (Betbeder, 1995). Another factor is the return and readaptation of the expats, and would restrict their mobility between very different cultures (Menanteau, 1995).

Public programs and policies for QHR migrations

Public policies for QHR emigrants may have different aims, such as retention, regulation or recuperation thereof by the countries of origin, or promotion and regulation by the destination country. On the other hand and as already mentioned, private sector policies are daily becoming more important.

In keeping with the cost-benefit appraisal of QHR migrations, governments may try to retain potential migrants via various programs. To regulate or promote migration in keeping with the needs and availability of the labor social structure, or with the supply and demand of labor markets ; or to recuperate these emigrants in programs such as return or association.

Retention Programs

Policy definition for *Retention* programs is based on the understanding that costs of such migration exceed the benefits, and they are directed at alleviating the causes of such movements. Different determinants have been identified as causing QHR migrations. PORTES sets out at least three levels (Portes, 1976) : the primary determinant where emigration of the elite is a consequence of international imbalance, allowing the industrialized countries to offer better salaries, work conditions, standard of living and social standing. This determinant correspond to the global explanation of other types of international migration (Mármora, 1972). A second determinant of professional emigration is produced by internal structural inconsistencies between the teachers supplied by an educational system and internal demand for their services. This level is that defined as the genesis of migratory processes, starting with the problem of the relation between production forms and available human resources in more general typologies (Mármora, 1972). The third determinant shows QHR emigration as a consequence of individual differences, coming from the person’s training and skills, current situation and network of contacts.

Considering these levels, it is clear that any policy in this respect should first consider the structural economic differences between countries. In this context, macroeconomic measures can

provide answers to the basic problem. One of the main proposals in recent years is that of the Commission for the Study of International Migration and Cooperative Economic Development. This Commission, composed by Republicans and Democrats in the United States, was set up to study the factors provoking undocumented migrants to the United States from western countries. It is the major contemporary effort in the search for impartial political proposals on this subject. Extensive consultation in and outside the United States, and a series of academic research projects reached two basic conclusions : one, that this immigration is caused by the search for better economic conditions and the other that the only way to gradually reduce such migration is to provide more and better jobs in the country of origin.

Another type of program proposed joint research between industrialized and non-industrialized countries, financed by the former and using equipment installed in the latter. An example is the agreement between the United States National Science Academy and the Russian Science Academy covering thirteen scientific fields (Schkolnikov, 1992). Some analysts, such as Boussaid of the University of Algeria, think this type of program may be mutually beneficial. Researchers in the developing countries make short visits to the industrialized countries where they have access to the latter's facilities and technical resources ; while those from the industrialized countries can learn about the needs and difficulties of developing countries (Boussaid, 1994).

Direct investment in research made by industrialized countries in poorer countries, is currently a mechanism used for cases such as the American Mathematics Society which provided US$500,000 in subsidies for Russian mathematicians ; or similar programs of the Swedish Science Academy providing aid to Baltic countries and other science academies to Eastern European countries. In this type of aid, mention should be made of the International Foundation for Science in the ex-Soviet Union, founded by a North American business man George Soros, with an initial budget of US$100 million (Schkolinikov, 1992). Despite the beneficial effect of international cooperation policies and programs on this problem, it is clear they cannot replace national development policies. The latter should include strategies for making better use of skilled labor, otherwise reverse technology transfer will continue to increase (Tapinos, 1993).

Another strategy put forward to retain QHR is that of increasing horizontal cooperation between developing countries, this should theoretically hold them in their countries or subregions. The programs have not been appraised in this sense, but their dimension and benefits for participants would have to be considerable if they are to achieve these aims.

Some authorities, such as Ardittis, consider this type of program could be successful in stemming exodus if the countries have administrative methods to allow for :

a. Preparing a list of available professionals and students for TCIC (both in cities and in outlying areas of the country).

b. Application of a recruitment system giving priority to residents.

c. Payment for those who move, similar to that of expatriates, and not a reduction of their " per diem " as occurs in cases such as Sri Lanka and some parts of Latin America (Ardittis, 1984).

Another effort to correct the distortion leading to reverse transfer of technology has been a Compensation Fund for skilled labor. This fund would allow countries supplying QHR to receive compensation to be used in development programs. While the idea was not rejected by the international community, various obstacles such as lack of statistics, or consensus on the definition of a skilled migrant have impeded setting up this fund (D'oliveria E Souza, 1989).

Another proposal in the same direction, has been to apply an international tax on each migrant, assessed on the receiving country. Resistance from industrialized countries and technical obstacles to its introduction, have prevented this proposal from prospering (Boussaid, 1994 ; D'olieira E Souza, 1989).

At the second level determining migration - that of internal instability or social injustice - there have been different programs and proposals. The first problem here is to what extent and in what conditions do internal problems and social differences increase QHR emigration. Authors such as Borjas question this hypothesis arguing that in countries with major differences of income, highly qualified persons earn well above the national average. While in countries where skilled and unskilled people have fairly similar income, the QHR would be more motivated to emigrate (Borjas, 1987).

Considering the above, QHR emigration, and consequently policies and programs to retain same, may differ depending on whether the country of origin is : structurally poor with no possibility of introducing retention mechanisms ; a developing country with unequal income distribution but highly favorable for qualified labor ; or an industrialized country where the economic factor is not a valid tool for retention. In this sense, the comments of Grubel and Scott are important, they refer to the reasons why English scientists emigrate, apparently for political, professional and psychological reasons rather than economic (Grubel & Scott, 1977).

Some countries have taken internal measures to stem the brain drain, such as increased funds for existing scientific institutions. While this generates more and better employment opportunities, in some case it has increased budget deficit and inflation, and served more to preserve the structure of inefficient organizations rather than promote the welfare of scientists. For these reasons, some governments have chosen another strategy which is that of directing investment to projects selected for their scientific and technical importance for national development (Schkolnikov, 1992).

Temporary migration of QHR to other countries constitutes another type of program appreciated by the countries of origin, since it retains the migrants and the home country benefits from the experience and income of the temporary migrant on his return.

Finally, the internationalization of the economy and extending markets in order to place high technology products, is a national economic strategy which can stimulate employment in the strata of highly skilled labor.

At the third level, and directly related to the afore mentioned individual costs and benefits of migrants, we can mention material incentives to technicians and scientists (in the form of loans or tax write-offs), or better promotion prospects, sometimes difficult in countries with rigid academic systems.

Another measure to retain QHR used by some countries has been to restrict visas and passports. Apart from violating the right to free movement, in practice these measures have been ineffective and have even increased the lack of transparency (Chongo Mundende, 1989).

Regulation and Promotion Programs

Regulation and promotion of QHR migration occurs first, when the flow exists and the aim is to direct it in keeping with certain aims, or, when it does not exist or is insufficient, and the aim is to encourage it. We can mention two types of immigration promotion policies : mass and selective. Following the Second World War, the need for skilled labor for economic and industrial development in some countries gave rise to the planning and execution of a sort of selective immigration : the so-called immigration programs for skilled human resources. These programs aimed to attract scientists, technicians and intellectuals, coming from post-war Europe. They were used mainly by industrialized countries such as the United States and the Soviet Union (for example, space projects) and, to a lesser extent, by countries such as Argentina, Canada and Australia where these programs were common in the 60s and 70s coinciding with their industrial effort. Bi-lateral agreements were an instrument used for these pro-

grams. For example Italy with Belgium in 1946 and 1947, with France in 1946 and 1947 and Argentina in 1947 and 1948 (ROVIRA, 1950). These programs could have been successful in the cases where the interests of exporting and importing countries coincided. But the increased exodus of qualifications from developing countries to industrialized countries, and efforts by the former to avoid this emigration, have been a counterweight and often blocked these programs when they implied a transfer of human resources towards the industrialized countries.

Despite these situations, the QHR migration programs have had a strong impact on development, as in the case of Latin America. They have been handled by international organisms such as the ex-CIM (today IMO) which started working in this field in 1964. Under this program, the IMO analyses priority sectors of the interested countries to detect the specific tasks requiring skilled human resources. These needs are notified to the IMO offices in Europe where the candidates are pre-selected, recruited, and given guidance and counseling.

To assure effective performance of this program, IMO has set up a Compensation Fund so that where necessary it can grant additional financial aid to immigrants when they first arrive. This support takes the form of salary subsidies, allowance per number of dependents, and installation expenses, and the amounts are adjusted depending on the qualifications of the candidates, their family group, promotion opportunities and salaries in the host country.

Another IMO mechanism used to assure migration is " Integration Assistance " where a health insurance is given for the initial period and there is help for unforeseen emergencies. From 1964-88 the IMO brought around 27,000 skilled European migrants via these programs. Also, to QHR data in Latin American countries, the IMO analyzed the data available in each country (Mármora, 1983).

Under current international migration policies, nearly all receiving countries, even the strictest, accept QHR. Australia, Canada and United States have increased the number and proportion of QHR in their immigration quotas. Some authors consider this policy largely accounts for the increase in " reverse transfer of technology " in recent decades (Chen Chin Long, 1989). Australia, under the influence of the Fitzgerald Report forecasts a significant increase in skilled immigration for 2031 (Appleyard, 1991). Canada has open legislation for migrants entering in the " independent " category ; this follows a selection based on education and skills. In this way, like Australia, it encourages immigration of businessmen and investors. Canada started its programs under the name of Business Immigrants, via the 1976 Immigration Act and 1979 Application Norms. By 1990, 8.5 % of Canadian immigrants obtained visas under the Business Program. While there is no definition on the capital to be brought by an immigrant, estimates are Canadian dollars $250,000 in small cities and Canadian dollars $500,000 in large cities. In 1986, the investor category was incorporated into these programs, with minimum investments of Canadian $250,000 and $500,000 depending on the province ; with five year investment periods (during which investment cannot be withdrawn) and net capital of between Canadian $500,000-700,000.

In 1985, the Parliamentary Committee for Labor, Employment and Immigration made an exhaustive review of these programs. Changes were mainly directed at simplifying access to Canada for skilled businessmen ; allowing the Canadian Employment and Immigration Committee (CEIC) and the provinces to directly contract businessmen and provide them with information, assisting them and their companies with installation, and allowing the CEIC to control admission requirements. At present, businessmen must appear every six months to show compliance with these requirements (Massen 1994).

In the case of Australia there was a " Business Migration " program whereby 36,555 people entered the country between 1982-90. A 1991 Parliamentary Commission analysis made changes such as compulsory monitoring at 12 and 24 months following arrival, a data system on the difficulties encountered by migrants to integrate themselves to the business community

in the country ; abolition of the accredited manager system and establishment of an admission point system, based on business aptitude, age, knowledge of the language and capital to be invested (Massen 1994).

As an example of this type of program sponsored by international organizations, we can name the IMO Agricultural Programs, whose purpose was to settle farmers with capital in Latin America. The Action Plan operates at two levels, aid for farmers and organizing visits to possible settlement areas. The USA Immigration Act of 1964 establishes skill as the predominant criterion for QHR admission. From the 80s, Great Britain managed to attract the skills needed via its work permit system. Japan has modified its immigration laws to stem illegal immigration but has also encouraged skilled immigrants, particularly from the Philippines and Thailand (Findlay, 1995).

In regulating migration of skilled personnel, consideration should be given to associating increases to international technical cooperation be it bilateral or multilateral.

The Consultant/Expert system, either associated or integrated, set up by the industrialized countries as aid to developing countries, or horizontal cooperation programs, are gathering momentum in QHR temporary migration. This latter cooperation system has increased in recent years, particularly in Latin America. Colombia, Argentina and Chile may be cited as examples of this type of cooperation in the form of QHR mobility. In 1978, under the sponsorship of the United Nations, the Buenos Aires Action Plan set out the aims of activities involved in this type of cooperation. In 1989 Colombia set up the Technical Assistance and Cooperation Fund for Central America and the Caribbean and later, in 1991, institutionalized the TCIC in its constitution. Progress in recent years, including bilateral agreements, has involved countries such as Argentina, Brazil, Chile, Honduras, Costa Rica, Mexico, Venezuela, Jamaica, Guyana and Surinam. Likewise, its TCIC has extended to Eastern Europe countries, such as Hungary and Rumania, and to North Africa and Nigeria. In 1994, it start a triangular cooperative exercise with Italy and El Salvador.

Chile's International Cooperation Agency performs an extensive TCIC program with different parts of the world. It covers two main areas defined as : scientific-technological-productive and organizational. Funding of the TCIC mission is shared with the requesting country. In the last ten years the Argentinean government has spent around US$20 million on TCIC. At present, the government has three funds for this purpose : one with the OAS for a million dollars, one with PNUD for two million and another with IMO for four million. During 1995, the Argentine TCIC fund with IMO handled over 400 cooperative acts, mainly in Latin American, but also in Algeria, Bulgaria, Equatorial Guinea, Russia, Senegal, Tunis, Ukraine. Seventy percent of this type of TCIC activity took the form of consultations, 20 % practical training in Argentina and 10 % seminars. Application is 31 % in public policy sector, 31 % in science and technology, 22 % in the productive sector and 16 % in services.

Recuperation Programs

Recuperating emigrated QHR is an objective of policies in both the host country and that of origin, they are normally implemented via programs of return or association. Programs for the return of immigrants aim to reinsert them in the place of origin. Here, a distinction must be made between migrants pushed by socio-economic reasons and those, often highly qualified, leaving for cultural or political reasons.

In some cases, the return is sponsored by the country of origin to recover migrated human capital ; in other cases the initiative comes from host countries who use repatriation to decongest their own labor markets. Many immigrants return spontaneously after accumulating a certain capital ; they contribute their experience and savings in their own country by engaging in some productive activity. In other cases, the government of the destination countries have instituted means to facilitate the return of these workers.

The situation is different for returning professionals and those exiled for political reasons. In the specific cases of Latin American there was a mass exodus following the military dictatorships of the 70s and 80s. Examples of this are emigrations in the last fifteen years. In Argentina, 0.98-1.3 % of the population had emigrated between 1970-85 and, in Uruguay, the figure varies from 10-13 % (Mármora-Gurrieri, 1988).

In Central America, displaced persons and refugees range from 250,000-600,000 in Guatemala, 350,000-500,000 in Nicaragua, and 1,100,000-1,600,000 in El Salvador (Weiss Fagen & Aguayo, 1988). The return of democracy to these countries brought back most of these exiles although, in general, there are no efficient mechanisms for their repatriation.

International programs exist for the return and re-integration of skilled migrants and they have been successful, such is the case of that performed by the IMO at the request of member states. This program is based on the concept that international migrations may be an important socio-economic element and contribute to evolution in developing countries (Pires, 1992).

Over 11,554 people returned to Latin America between 1970-1989. The IMO program for Africa, in its first phase (1983-87) assisted 568 African nationals return ; in the second phase (up to March 1992), another 730 nationals received aid (mainly Zimbabwe, Kenya and Ghana). Also the IMO, financed by Japan, undertook return programs for Afghanistan and Cambodia (Pires 1992). These programs are part of incorporation policies, and their aim is a joint effort between host and origin countries to return people to their home country. Measures taken by the host countries should give favorable consideration to technical, administrative and financial support to settle the returning workers. Regarding the countries of origin, they could help with more detailed reporting on these returns (IMO 1985).

These program reveal three subjects, distinct from conceptual and operational viewpoints, and generally submitted at different times : return forecast, emergency aid and social and labor insertion (Mármora, 1989).

Association programs with the migrant population is part of recuperation policy and aims at an effective link between nationals living outside their country of origin and the society of said country.

They are stated and developed on the assumption that emigration is not forcibly a loss for the country of origin, it can be beneficial.

The association programs are : motivational and occupational. The first aim to encourage migrants to taken decisions benefiting the country ; and the second to provide conditions so that such decision may be effective (Maletta, 1988). The first component is essential if the second is to be effective. The motivational aspects of these programs refer to participation in elections, citizens charter, communication/information on the country of origin and educational policy directed at migrants.

The operational aspects are : indicate scientific, technological and technical cooperation ; business cooperation, humanitarian cooperation and private economic flows. Scientific, technological and technical cooperation is based for “ transfer of knowledge and technology ” needed by many countries of origin for their socio-economic development.

According to the outline proposed by Maletta, the main forms of this cooperation, and which in effect take place spontaneously, are :

* Frequent visits to the country to take part in seminars, congresses, courses and other events with local students and colleagues. An example is the TOKTEN program starting in 1976 as an initiative of the Turkish government and the United Nations Development Program. The principal objective is to take advantage of the specialized knowledge of expatriates so they contribute to development in their country of origin.

* Acceptance of post-graduate students, distance management of graduation papers for students living in the country of origin, channeling information on scholarships and other means of support for training young scientists.

* Perform research projects in conjunction with scientists in the country of origin, using national and foreign financing sources. In particular, associate scientists in the country of origin with projects where direct access to financing is not available from their own country.

* Encourage scientists living abroad to concentrate on subjects of special interest to the country of origin.

* Establish horizontal cooperation networks for the exchange of scientific data among emigrant and non-emigrant scientists (Maletta 1988).

Regarding the impact of these different lines of cooperation, some " brain drain " appraisals specifically refer to the TOKTEN program. Here there are two basic questions : Can it promote permanent return of an emigrant QHR ? Can it in some way replace technical emigrants ?

In the first case, an analysis of 700 consultants mobilized by TOKTEN between 1977-83 showed that only two chose permanent return (Ardittis 1984). In this sense, it should be noted that TOKTEN was not specifically addressing return. The second question, replies refer to the possible counterpart between the specific requirements of the country of origin at a particular stage of its development and the effective availability of QHR in the program " pool " (Ardittis, 1984).

Regarding business cooperation, it should be pointed out that the existence of a emigrant community in different parts of the world provides access to export, capital and technology markets far larger than those of the country of origin itself. In an economy constantly becoming more interdependent, the existence of persons with business talent and experience living abroad, is a very valuable asset for a country wishing to increase its presence in international markets (Maletta, 1988). In turn, the knowledge of export markets for goods coming from the country of origin and access to capital markets gives emigrants an advantageous position be it as exporters, agents for access to risk capital or international bank loans for projects generated in the country of origin.

Regarding humanitarian cooperation, this may be implemented through channels supporting the poorer sectors in the country of origin, by emigrants or groups of emigrants in the host country. Other recipients of this cooperation could be educational or scientific establishments in the country of origin, receiving equipment/books for research and teaching. These aids may be transferred by governmental or non-governmental organisms. Support may take the form of concrete actions such as, mother-child nutrition, attention for needy children via foster parent programs etc. These can be channelled via different institutions as proposed by governmental or NGO entities. The aid process should include mechanisms to send materials or money. Residents abroad, particularly QHR may contribute funds personally or channel institutional funds available in the country of residence and not easily obtained in the country of origin.

Finally, regarding private funds, either in the form of remittance or bringing fixed assets back to the country, these can be encouraged via special conditions for exchange, tax, customs.

Private programs and policies for QHR migrations

QHR mobilization promoted by the private sector reflects the interests and strategies of this sector and does not necessarily coincide with public policies. It is an accepted fact that we are far from knowing how public policies affect measures taken by multinationals in strategies to

transfer skills and appraise human resources in their internal labor markets. In this sense, Findlay recommends that developing countries should try and take advantage of QHR migrations in the multinationals to intensify technology transfer and find a way to prevent foreign professionals just " renting " their skills on a temporary basis (Findlay, 1993).

Policies of private companies in this context have changed over time, going through different stages (Lebaube, 1995). First, in the European colonies, particularly Africa, expats were abroad for long periods. Away from their home for most of their career, they were generally incapable of professionally reintegrating to their country of origin.

In the 70s a different international mobility arose. It was necessary to train professional teams to work anywhere in a world already internationalized by commercial exchanges. Teams of professionals settled in the subsidiaries in order to set up production and organization systems. The companies took a short-term view ; bringing QHR to places where there were no local experts was the easiest way to assure a logistic base at each site (Beuve-Mery, 1995). The expats during this stage had all sorts of advantages, lodging, car, bonuses etc. Under this system, corporate expansion was expensive in monetary and human terms when the expat returned, due to the high standard of he enjoyed abroad.

In the 80s, corporate policy changed to meet the demands of restructuring. For economic reasons they restricted the number of expats, and change the nature thereof. Instead of experienced teams, they started to send young graduates on the assumption that foreign experience could improve their skills.

At present, there is a return to using teams, more than in the 80s but less than the 70s. Migrations of QHR for transnational companies takes the form of greater integration with the firm's organizational culture and strategies (Lebaube, 1995). As large companies grow, they specialize and their internal relations become more complex. QHR migration is one aspect of these internal relations.

Corporate strategy, specially when choosing between horizontal expansion and vertical integration, is going to affect its structures and, therefore, its personnel movement. In any case, companies organized on " organic " principles, with state-of-the-art technology and constant innovations, need specialists able to move rapidly (Salt and Findlay, 1989). In this way, the structure of the QHR migratory movement is going to depend on corporate policy with regard to spatial distributions, as well as preferences in the geographical distribution of work. One of the main reasons for these movements is that by displacing its own personnel, the company retains its technical superiority and research advances.

The advantages for an ex-pat will depend on the country or region where he is sent. It is preferable to move QHR within the same geographical region, since integration difficulties will be specially appraised by the companies (Menanteau, 1995) -despite or because of the cultural microclimate in which the person normally lives (King, 1976).

Transnational companies increasingly adopt job classification via a salary ladder for each position. A package of services are offered to the migrant QHR to make his relocation easier, this includes housing (rented or purchased) and all types of administrative procedures allowing him and his family to settle. In this context, the labor markets and the demands they generate are going to be covered by transfers between the companies themselves rather than via " free competition " (Findlay, 1993). The flow of skilled labor will be increasingly assigned by those determining production structure worldwide, or by international recruiting agencies (Salt and Findlay, 1989) rather than by the restrictions or opening up of public policies (Gould, 1988).

Despite these policies to move teams, there is evidence that some companies are tending to reduce QHR movement, using other strategies such as " joint ventures " (use of local experts) or the growing contracting of specialized services (Keeble, Bryson and Wood, 1991).

Conclusions

The increase in QHR movements, produced by growing trans-nationalization of the economy and other factors, has given rise to different comments on the validity of the processes associated to this problem.

In principle, it can be noted that the different concepts overlie and coexist in the current migratory processes, instead of canceling each other out. The brain drain continues to exist ; reverse transfer of technology has increased, together with the growing gap between the industrialized and developing worlds ; and " exchange of skills " has acquired increasing importance, both in the public sphere of international cooperation and the private sphere of the transnational companies.

It is noted that migration in general, and the QHR in particular, favor the country of origin in the short-term by decongesting labor markets affected by over-supply and the remittances sent by the migrants. Likewise the host country benefits from a permanent and growing flow of human capital whose reproduction costs have been assumed by the country of origin.

In the medium-term, the QHR shortage may have a negative effect on the country of origin since, as has been shown in some incipient economies, the existence of QHR is not a consequence but a pre-condition for economic growth in present international market conditions.

Regarding public policies for QHR migration, there are different strategies directed at retention, regulation, promotion or recuperation of this type of migrant. QHR retention policies, as any other policy of this type, depend foremost on the possibility of changing those structural factors which are more attractive in the developed countries. Specific programs offering QHR better professional and living conditions, either via bilateral agreements or measures to encourage internal investment in high technology sectors, as well as special subsidies for science, are currently being introduced in an attempt to retain skilled personnel.

The regulation and promotion of skilled immigration is the base of migratory policies of major host countries in recent decades. Restrictive selection is the migration strategy adopted in the United States, Canada and Australia, as well as some European countries receiving migrants after the Second World War.

In programs regulating QHR movements, it is important to note the increase in international technical cooperation and, specially, horizontal cooperation between developing countries. In Latin America this has become more important.

Regarding recuperation of the skilled migrant, two programs have had reasonable success in recent years : return and association. The former have had a certain selective success in Africa and Latin America. The second, we may mention the TOKTEN program and other initiatives using QHR resident abroad, encouraging them to take an interest in needs detected in the country of origin. While the programs for return have not been effective, the fact of mobilizing human resources in terms of technical cooperation, is considered by some authors as moving from " passive to active " in this matter.

Finally, it is fundamental to include private sector policies for this group of migrants. Different stages of production and organization of the transnationals have determined different movement strategies for QHR. At present, it can be said that this movement owes more to corporate decisions to relocate professional teams, than to Governmental policies to restrict or promote migration.

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Politicas y programas de migraciones de recursos humanos calificados

Lelio Mármora

El concepto de migración de recursos humanos calificados

Las migraciones de científicos constituyen parte de los actuales movimientos internacionales de RHC, en los cuales se pueden incluir también los de profesionales, técnicos, ejecutivos y empresarios. Cada uno de ellos tiene su específica particularidad, pero desde el punto de vista de las causas, efectos e incluso posibles respuestas institucionales, conforman un sector del conjunto de las migraciones con características relativamente comunes.

El análisis de esta categoría más amplia del fenómeno de la movilidad humana permite un acercamiento global a la problemática y a la propuesta de algunas hipótesis al respecto. Esto no implica dejar de lado la especificidad del científico migrante, sino más bien tratar de entenderlo a partir de un contexto que lo contiene y del cual pueden extraerse elementos para su comprensión particular.

Un hecho remarcado por diferentes analistas es, en las últimas décadas, el incremento de las migraciones de recursos humanos calificados (SALT, 1983 ; FINDLAY, 1990 ; APPLEYARD, 1991 ; GHOSH, 1992), así como las características de relativa corta duración del término de estadía de estas migraciones (SALT y SINGLETON, 1995).

Existe consenso también en que la creciente movilidad tiene diferentes niveles de explicación, que van desde la relación macroeconómica entre los países hasta la situación psicosocial del migrante (PORTES, 1976).

A un nivel macroeconómico, es evidente que la globalización de la producción, con el consecuente crecimiento de las firmas transnacionales (SASSEN, 1988), así como el crecimiento de las economías de algunos países en desarrollo con demanda insatisfecha de recursos humanos calificados, ha incrementado su movimiento (FINDLAY, 1990). También han influido en este fenómeno de creciente movilidad, los cambios en la organización de las formas de producción en la economía moderna (TACHIKI, 1990) y la incidencia del aumento de la velocidad de los medios de transporte en los viajes de corta duración de ejecutivos y técnicos (SALT y SINGLETON, 1995).

Desde el punto de vista político, han contribuido especialmente las políticas de restricción selectiva -abiertas para cierto tipo de migrantes calificados- adoptadas por los países de recepción en las dos últimas décadas (APPLEYARD, 1991), así como hechos puntuales pero de gran impacto mundial, como la descomposición política de los ex regímenes socialistas (BARNATHAN, 1991 ; SCHKOLNIKOV, 1992).

Por otro lado, es claro que si bien la globalización económica y los demás factores señalados constituyen la base explicativa de esta creciente movilidad de RHC, existen fuertes procesos coadyuvantes e incluso, en algunos casos, determinantes, tales como la globalización cultural.

La transnacionalización de la cultura estaría brindando, para algunos estratos calificados, una base común que les permite migrar y asentarse en otros países sin necesidad de "aculturarse". Pueden vivir en las nuevas sociedades sin necesidad de integrarse, como debían hacerlo los migrantes de principios de siglo, pero no por ello son marginales. Interactúan con otros miembros de la sociedad receptora y otros migrantes que comparten similares elementos culturales, no por su pertenencia étnica o nacional, sino por su posición social, su situación etaria y su vinculación laboral.

Se mueven en un mundo con pautas transnacionales, donde las culturas nacionales no tienen -para ellos- más importancia que la de la curiosidad folklórica. Sus hijos se educan en centros educacionales especiales, que mantienen los mismos patrones en cualquier país al que se desplacen. No se esfuerzan por integrarse a la sociedad receptora porque saben que su estadía es temporaria. Y quizás lo más importante, es que su protección laboral y social depende mucho menos del Estado nación del cual son ciudadanos, que de la empresa transnacional en la que trabajan. Ejecutivos, técnicos especializados, expertos, consultores de todo tipo, constituyen esta nueva y creciente población en movimiento que pone en cuestión el mismo concepto de migración.

Las diferentes formas que adopta su desplazamiento y estadía transforman a estos movimientos de población en un fenómeno diferente a la concepción clásica de las migraciones. Su visibilidad es mucho más reducida que la de las migraciones masivas, ya que se mueven en espacios a la vez cerrados e internacionales. La programación de su movimiento depende, en principio, de las políticas de las empresas u organizaciones a las que pertenecen, mientras que es discutible el papel de las políticas de los Estados en su promoción o regulación. Son, al mismo tiempo, producto de la restructuración económica de la sociedad post-industrial y exponentes netos de la cultura transnacional que la acompaña.

El incremento de este tipo de migraciones, su especial composición y su rápida y a veces corta movilidad en el tiempo, han generado diferentes interpretaciones, no sólo sobre este fenómeno particular, sino también sobre el concepto mismo de los futuros movimientos de personas (ZOLBERG, 1989).

Un primer punto que es importante aclarar es que si bien estas migraciones han aumentado, siguen siendo una pequeña proporción de los movimientos migratorios mundiales, y que su importancia reside especialmente en sus características cualitativas más que cuantitativas.

En ese sentido, son cuestionables las generalizaciones sobre el cambio de las migraciones en general, a partir de las modificaciones observables en este segmento de las mismas.

Por otra parte, se hace necesario un análisis más detenido sobre dos problemas conceptuales que se plantean alrededor de la evolución de esta temática.

El primero es el que se refiere a la pertinencia actual del concepto "migraciones". El segundo, es el relativo a la validez conceptual de la "fuga de cerebros".

Con relación al primero de los problemas, el incremento de la movilidad de RHC y la corta temporalidad de sus estadías ha llamado la atención sobre la necesidad de reconceptualizar las migraciones en su llamada concepción "tradicional". Esta concepción sería la de la migración permanente, de traslado familiar para un asentamiento fijo, quizás pensando en el modelo de los movimientos masivos de principios de siglo. En esta visión crítica, las actuales migraciones de RHC, en contraposición a las primeras, deberían ser analizadas como "movimientos" poblacionales de corta duración.

Lo cierto es que siempre ha habido migraciones laborales temporales, tales como las grandes migraciones "golondrinas" de principios de siglo. Lo que aparece en la actualidad como un nuevo fenómeno es la creciente migración temporal de personal calificado. Este hecho no resultaría suficiente para plantear la necesidad de modificar el concepto de migraciones. No obstante, una definición más precisa del mismo puede ayudar a evitar confusiones con respecto a lo que estamos realmente describiendo o explicando.

En ese sentido, es importante tener, en principio, un punto de definición sobre lo que se considera "migración humana".

Si el atributo que la define es sólo el espacial, siempre nos queda la duda de cuál es la distancia mínima que vamos a considerar para catalogar a una persona de migrante. ¿Los límites geográficos ? ¿La mayor o menor cantidad de espacio recorrida ?

Si el atributo es el tiempo, también caeríamos en planteos arbitrarios sobre cuál es el considerado para definir a un migrante. ¿Hasta qué punto alguien que se desplaza por un corto tiempo, para desarrollar una labor en otra parte, está migrando ? ¿Cuál es la unidad de medida que permite diferenciar los distintos tipos de migraciones ? ¿Hasta qué punto categorías como la "permanente" o la "temporaria" engloban movimientos migratorios totalmente diferentes ? (PRICE, 1989).

Si es laboral, ¿qué pasa con los jubilados o con los desempleados que migran ?

En función de estas limitaciones, se propone una definición que combine el hecho de trasladarse espacialmente con el cambio sociocultural, en función de la "reproducción cotidiana de la existencia de la persona...."(MARMORA, 1989).

La migración implica el asentamiento en un lugar diferente al de residencia anterior, desde el cual la persona desarrolla las relaciones que hacen a su sobrevivencia socioeconómica.

El turismo no sería migración, por el hecho de que el traslado no se realiza con el objeto de instalarse para la reproducción de su vida social, cultural y/o laboral, sino para el descanso o el esparcimiento.

Un segundo problema es el referente a la validez del concepto de "fuga de cerebros", dadas las actuales características de la movilidad internacional de RHC.

La "fuga de cerebros", tal como este proceso es calificado a partir de 1962 por la Sociedad Real Británica en un informe sobre la emigración de científicos y técnicos de ese país hacia los Estados Unidos (OIM, 1990), es considerado desde una perspectiva negativa para los países de origen a partir de la década del 60.

Con el objeto de ampliar la definición a todo el personal calificado la caracterización del fenómeno se va a definir, a partir de los 70, como de "éxodo de competencias". En la Tercera Reunión de la Conferencia de las Naciones Unidas sobre Comercio y Desarrollo, en 1972, se lo definirá como un problema de "transferencia inversa de tecnología" (TIT). En dicho contexto, se reconoce la pérdida que implica, para los países en desarrollo, la emigración de sus recursos humanos más calificados y la contradicción existente entre esta transferencia inversa de tecnología y los esfuerzos de la comunidad internacional para acelerar el desarrollo de aquellos países afectados por este flujo negativo (OIM, 1990).

Las teorías de "capital humano" son las que dan marco a esta posición, y encuentran en la emigración de personal calificado desde países en desarrollo hacia los desarrollados, una muestra de las relaciones asimétricas entre los mismos (FERNANDEZ LAMARRA).

Bajo los auspicios de la UNCTAD se efectuaron, en la década del 70, diferentes estudios en países tales como la India, Filipinas, Sri Lanka y Pakistan (LOGAN, 1992) y, a partir de otras iniciativas, el fenómeno también se analizó en otras regiones como la latinoamericana (OTEIZA, 1965 ; OZLAK y CAPUTO, 1973 ; SANCHEZ CRESPO, 1969 ; GUTIERREZ OLIVA y PEREZ RIQUELME, 1965).

Dada la naturaleza circulatoria de estos movimientos de fuerza de trabajo altamente calificada, algunos autores habrían sugerido el concepto de "intercambio de competencias" como más adecuado que el de "fuga de cerebros" (FINDLAY, 1990).

El problema en este tipo de definiciones es el de los significados que contienen. En el caso de la "fuga de cerebros", se presuponía una pérdida de capacidad humana para el país de origen ; en el de "éxodo de competencias", la interpretación fue más general, abarcativa de personal con

diferentes aptitudes técnicas (BOUSSAÏD, 1994); la noción de "transferencia inversa de tecnología" implica la relación entre una parte menos desarrollada, que pierde en beneficio de otra con mayor desarrollo relativo; el "intercambio de destrezas" estaría proponiendo una especie de distribución internacional del trabajo de los RHC en función de demandas insatisfechas, sin consideración del nivel diferencial de las partes entre las que se efectúa el intercambio.

Es probable que estas diferentes terminologías sean adecuadas, no para definir fenómenos que predominan en diferentes etapas, sino que coexisten en la actualidad.

Así, la fuga de cerebros explica la emigración de RHC desde cualquier lugar a otro. Es decir, tanto desde países desarrollados entre sí, como desde países en desarrollo hacia otros desarrollados. En su definición, está implícita también la migración permanente. Este tipo de movimiento poblacional sigue existiendo, e incluso se encuentra en claro aumento. Por ejemplo, si se toman las características de extranjeros radicados en los Estados Unidos por año de entrada, puede observarse que, mientras entre los migrantes ingresados antes de 1990 el porcentaje de profesionales era de alrededor del 7,5 %, el de los ingresados entre 1990 y 1994 es del 11,4 %, provenientes tanto de países en desarrollo como desarrollados (HANSEN, K. Y BACHU, A., 1995).

Dentro de este contexto de "fuga de cerebros", también sigue existiendo "la transferencia inversa de tecnología" observable en el hecho de que, entre 1961 y 1983, por lo menos 700.000 científicos, ingenieros, doctores y otras personas altamente calificadas, emigraron desde los países en desarrollo hacia los Estados Unidos, Canadá y Australia (STALKER, 1994).

Y por último, el "éxodo de competencias", o bien, en su forma más dinámica, el "intercambio de destrezas", se ha multiplicado en las últimas décadas como otro tipo de migración temporaria, en algunos casos de corta permanencia. Se da preferentemente entre países desarrollados o desde éstos hacia países en desarrollo, frecuentemente en el marco de estructuras productivas multinacionales, o en la forma de cooperación técnica para el desarrollo. Encontrando también en los últimos años, un incremento de la llamada cooperación técnica horizontal entre países en desarrollo (CTPD).

Estamos frente a diferentes patrones migratorios de RHC, que se dan en forma contemporánea. Todas las formas de migración de RHC han aumentado en los últimos años, sin que esto implique que unas han reemplazado a otras.

En esta realidad surgen algunas preguntas, tales como si las migraciones temporales entre países en desarrollo podrían incidir en una disminución de la transferencia inversa de tecnología. Esta presunción se basa en la posibilidad de que, al ampliarse el mercado de trabajo desde un espacio nacional a áreas regionales, la posible ubicación temporal de RHC en dichas áreas permita absorber la oferta redundante sin necesidad de que ésta deje definitivamente su país de origen. Este ha sido uno de los argumentos de los propulsores de la CTPD. Si bien no existen evidencias empíricas que permitan verificar esta hipótesis, hasta ahora nada indica que, a mediano plazo, esta no sea una posibilidad de retención de RHC. Pero, en la práctica, la función de la movilidad temporal en la forma de CTPD no es la de mejorar los ingresos o generar empleos, sino la de "intercambiar competencias" entre países con similar grado de desarrollo.

Costo-beneficio de la migracion de RHC

Frente al fenómeno creciente de migraciones de RHC en sus diferentes modalidades, se han ido estructurando distintas políticas públicas y privadas para sus definiciones, y el análisis de costo-beneficio ha ocupado el centro de la discusión. Para sus desarrollos, diferentes programas han sido propuestos y ejecutados.

En primer lugar, cabe preguntar quién hace las políticas.

La concepción tradicional ubica esta responsabilidad en los Estados que promueven, restringen o regulan los flujos migratorios, mientras que el sector privado presiona, acompaña o utiliza las políticas estatales en función de sus necesidades y beneficios. En las crecientes migraciones de RHC, parecería que el papel del sector privado en función de sus políticas estaría en algunos casos -como el de las transnacionales- incidiendo en forma determinante en la orientación y características de estos flujos (SALT y SINGLETON, 1995).

No obstante, es evidente que son las respuestas institucionales de los Estados las que siguen jugando un rol preponderante en el tema, pero con espacios cada vez más compartidos con otros sectores económicos y sociales.

El análisis costo-beneficio constituye el fundamento básico de las políticas sobre este tema, y de él dependen los objetivos que dichas políticas se planteen.

En el caso de las políticas públicas, el costo-beneficio de la fuga de cerebros, en especial cuando ésta constituye transferencia inversa de tecnología, ha sido analizado a partir de diferentes perspectivas, en función de su impacto sobre el desarrollo de los países de origen y de los países de llegada.

Con relación a los países de origen, existen posiciones positivas y negativas en cuanto a estos efectos.

Se pueden identificar aquellas posiciones favorables a la emigración, ya que observan un efecto positivo sobre la disminución del empleo y subempleo de los países de expulsión (PARODI, 1970 ; POLYZOS, 1970 ; MALETTA, 1988), o bien sobre el circuito económico del país expulsor, debido a la incidencia de las remesas (PAPADEMETRIU, 1962). Sobre este último punto, cabe destacar también el efecto favorable que las remesas van a producir en el nivel de vida y desarrollo de las familias de los emigrados, lo cual repercutiría en el desarrollo global de los países de origen (PURCELL, 1992 ; MURILLO, 1979).

Por la otra parte, se ubican preferentemente los cuestionadores del éxodo de competencias, debido a los costos sociales de reproducción que el país expulsor pierde con esta emigración, así como a la exclusión del personal mejor calificado y con cualidades de liderazgo esenciales para los procesos de desarrollo (THALES DE AZEVEDO, 1968 ; SIJL, 1971 ; LOGAN 1992 ; FERNANDEZ LAMARRA, 1992). En la segunda perspectiva pueden mencionarse aquellos analistas que ven, en la pérdida poblacional, una disminución de las posibilidades de consumo en economías cuyo potencial de desarrollo se basa, parcialmente, en la activación de su mercado interno (SINGER, 1971).

En esta perspectiva, con respecto al costo que representa este tipo de emigración para los países en desarrollo, diversas estimaciones han intentado una cuantificación del mismo. Así, una estimación efectuada en Canadá plantea que los países del Tercer Mundo habrían contribuido con 10 billones de dólares por este concepto, en los 25 años, y en Hong Kong, el cálculo de graduados migrantes, entre 1987 y 1989, representaría 74.400 años de enseñanza universitaria (SALT, 1994).

El costo del capital humano emigrado aparece así como una transferencia que los países en desarrollo estarían efectuando, en la cual puede cuantificarse el valor que representa la reproducción y capacitación de dicho capital.

Otro costo que aparece es el referente al impacto social de la falta de cierto personal calificado, necesario para el bienestar de una sociedad, como por ejemplo lo que representa emigración masiva de médicos y personal de la salud (BOUSSAÏD, 1994).

El otro costo señalado por los autores citados es el del retardo de la capacidad tecnológica de un país en desarrollo cuando sus RHC migran, ya que este drenaje de personal calificado está erosionando la base de recursos con que el país cuenta para su propio despegue económico.

Todos estos argumentos han sido cuestionados por autores que plantean la necesidad de no tomar los costos medios de un egresado para calcular el gasto educativo, sino los costos marginales. Es decir, el incremento del presupuesto universitario por cada nuevo estudiante que se sume a la matrícula existente (MALETTA, 1988).

Asimismo se señala que, aun cuando no estudiaran muchos de estos jóvenes, igualmente no podrían trabajar por la alta tasa de desempleo juvenil de estos países. En el caso de los egresados habría, a su vez, un desbalance estructural entre la producción de mano de obra y su demanda efectiva. La primera sería desproporcionada con respecto a la segunda (MALETTA, 1988).

Dos observaciones pueden hacerse a estos comentarios. La primera, que la demanda de RHC establecida por el mercado no corresponde, necesariamente, al requerimiento que la sociedad tiene de estos RHC. Es decir que, aun cuando el mercado no genere puestos de trabajo, eso no significa que la sociedad no esté necesitando a ese profesional. En ese caso, no es que los aparatos educativos estén sobrevaluados porque producen más profesionales que los necesarios, sino que los mercados están subvaluados con relación a las necesidades de la sociedad en su conjunto, ya que no están generando la demanda de los servicios que esa sociedad requiere para un efectivo desarrollo humano y los RHC indispensables para su crecimiento económico.

De esa forma, frente a la interpretación “válvula de escape”, en la cual se presupone el costo que implica un excedente de personal calificado que el mercado no puede absorber, se sitúa una perspectiva opuesta. Esta última coloca la existencia de RHC como un requisito para el desarrollo, aun cuando su producción no responda inicialmente a la demanda del mercado de trabajo.

En ese sentido, son concluyentes los resultados del estudio econométrico realizado por el Overseas Council de Washington en el sudeste de Asia (FISHLOW, 1994). En dicho estudio se demuestra que los niveles previos de educación y la estructura de distribución de ingreso y de la tierra, explicaban más del 50 % de la variación de las tasas de crecimiento de los países. El papel de “plataforma de lanzamiento” que cumplió la existencia de RHC, aparece con claridad en países como Corea, Taiwán, Malasia y Tailandia, en los cuales el 90 % de su crecimiento se explicaría por los elevados niveles de educación y de igualdad existentes hacia 1960 (CALCAGNO y CALCAGNO, 1995, p. 221-222).

La diferenciación entre la “estructura social del trabajo” y el “mercado de trabajo” y sus diferentes combinaciones en términos de requerimientos y disponibilidades, por un lado, y de oferta y demanda, por otro, permite la incorporación de otro concepto clave para el análisis de los costos de la emigración de los RHC : el de escasez (LEPORE, GURRIERI y MARMORA, 1984).

La escasez estructural de RHC se daría cuando, frente a los “requerimientos” de los mismos por parte de la sociedad, no existen suficientes “disponibilidades”. La escasez coyuntural se expresa en los desequilibrios generados por una demanda insatisfecha.

A partir de las distintas situaciones analizadas, que se colocan tanto a nivel estructural de la sociedad como al nivel coyuntural de los mercados de trabajo, se puede sostener en primer lugar una premisa que se considera básica : el hecho de que un determinado RHC no sea escaso en el mercado de trabajo no quiere decir necesariamente que no sea escaso, de acuerdo a los requerimientos que tiene la sociedad de esos RHC.

Esta consideración tiene suma importancia, ya que puede llevar a conclusiones totalmente diferentes en cuanto a las causas y efectos que la emigración de RHC tiene para los países de origen.

Si el análisis queda contenido dentro de la lógica del mercado y sus leyes, el simple hecho de que un RHC no tenga demanda en el mercado de trabajo implicaría que no es necesario en una sociedad dada y, por lo tanto, su salida no sería perjudicial para el país de origen, sino hasta beneficiosa para el mismo, en términos del mercado laboral.

Esta última perspectiva, denominada comúnmente “válvula de escape”, ha sido aceptada por algunos marcos interpretativos que consideran que la emigración de RHC como proceso de cir-

culación de capital humano permite una asignación más eficiente de recursos humanos a nivel mundial (JOHNSON, H., 1968 ; GRUBEL, H., 1966) ; o bien contribuye a la regulación de una oferta excesiva frente a una demanda escasa en los mercados de trabajo nacionales, siendo considerada en algunas situaciones como beneficiosa, ya que permitiría un incremento de la utilidad para quienes se quedaron en el país (SIJL, 1971). En este marco analítico se obviaría cualquier consideración que pudiera hacerse sobre la necesidad real que determinada sociedad tuviera de esos RHC, ocultando, de alguna manera, las imperfecciones mismas que el mercado de trabajo tiene y su correspondencia o no con la estructura social donde se encuentra operando.

Teniendo en cuenta los elementos señalados, pueden distinguirse cuatro situaciones con relación a la escasez de RHC (LEPORE, GURRIERI y MARMORA, 1984) :

- Escasez estructural. Existe requerimiento de RHC pero no hay disponibilidad.
- Escasez de demanda. Existe requerimiento y disponibilidad pero no existe demanda.
- Escasez de oferta. Existe requerimiento, disponibilidad y demanda pero no existe oferta.
- Escasez cualitativa de la oferta. Existe requerimiento, demanda y oferta pero no hay disponibilidad.

Un primer tipo de escasez de RHC a señalar, propia de las sociedades en desarrollo, es la "estructural".

Aquí el gran costo de la emigración es el de restar al país de origen los RHC requeridos para su desarrollo económico social. En este punto es importante tener en cuenta lo que se ha denominado "capacidad de reproducción" de los RHC (HARBISON, F. y MYERS, C., 1961), ya que dicha capacidad constituye una variante clave para interpretar el real efecto que estas migraciones pueden producir en el país de origen.

Esta variante constituiría un enfoque más dinámico para estimar el efecto de la emigración que el de la comparación entre el volumen de la emigración de RHC y las disponibilidades de los mismos (KIDD, Ch., 1970 ; CHAPARRO, F.,1971).

Un segundo tipo de escasez sería la "escasez de demanda". Los efectos de ésta son visibles como uno de los componentes de los factores de expulsión de RHC, pero no por exceso de los mismos ante los requerimientos de la sociedad sino, como se vio anteriormente, por insuficiencia de los mecanismos de esa estructura social para generar la demanda correspondiente.

Esta situación, denominada de "tensión estructural" por algunos autores (SITO, N. y STUHLMAN, L., 1968), implicaría que, más que la pobreza o el subdesarrollo, las causas de este tipo de emigración resultarían del desequilibrio que se da entre la capacidad de un país para producir RHC y su capacidad de absorberlos (SASSEN-KOOB, S., 1978).

Un tercer tipo de escasez identificado es la "escasez de oferta" de RHC, en la cual, existiendo la disponibilidad y la demanda, no habría interés por parte de los profesionales y técnicos de cubrir dicha demanda, generando también una corriente migratoria.

La deformación del tipo de enseñanza que se brinda, en algunos países en desarrollo, a los RHC se debe, entre otras causas, a la importación indiscriminada de modelos y técnicas desde los países desarrollados.

A través de estos modelos y técnicas, portadores de una determinada dimensión ideológica, cultural y política, y de una explícita propaganda de ciertas tecnologías e instrumental, se logra como consecuencia secundaria un efecto de demostración de estilos de vida y de ejercicio profesional que resulta de gran importancia en la decisión de migrar de los RHC.

Por otro lado, dichos efectos se acrecientan aun más en aquellas economías, o etapas de economías de los países en desarrollo, que se caracterizan por estilos de crecimiento "hacia afuera", basados en una economía de exportación, los cuales promoverían flujos de emigración de mano de obra calificada y no calificada (PORTES, 1982).

Esta última modalidad de escasez -en los países de origen de la migración- es más grave que las otras dos, ya que el RHC emigrado por insatisfacción con la demanda, será difícilmente reemplazado en su país de origen (SASSEN-KOOB, S., 1978). Además, produce un efecto decreciente en el nivel actual de actividad económica y, más aún, reduce las posibilidades de reactivación de esa actividad a corto plazo. Y, por último, las posibilidades de retorno de este RHC serían menores que las del motivado a la emigración sólo por la escasez de demanda, ya que normalmente se dirige al país de destino con el propósito de integrarse definitivamente.

Su decisión está determinada no sólo por una insatisfacción básica con respecto a lo que su país de origen le ofrece, sino también por lo que le ofrece la estructura del mercado de trabajo y el marco cultural y social general del país al cual se dirige.

Por estas razones, su decisión estará orientada a una emigración más definitiva que circunstancial, lo cual se fortalece cuando el traslado se efectúa a países de una mejor calidad de vida, donde el RHC puede asimilarse con su familia en condiciones laborales y sociales en general más ventajosas que en su país de origen.

Otro tipo de escasez, la cualitativa de la oferta, es entendida como una disponibilidad no adecuada para la demanda existente de RHC y estaría determinada por dos factores concurrentes.

Por un lado, tal como se señaló con anterioridad, la misma respondería a una capacitación inadecuada de los RHC, más orientada por una dinámica propia que por los requerimientos y demanda del mercado de trabajo.

Por otro, se puede decir que en un punto determinado, el flujo de migración de RHC, que es selectivo, retiraría del mercado a sectores de RHC difícilmente reemplazables.

Como ejemplos de esta situación se pueden citar experiencias como la colombiana donde, a pesar de ser un país de gran disponibilidad y oferta de RHC sin posibilidades de demanda (TORALES, 1980) en ciertas áreas como, por ejemplo, la de textiles en el Valle de Aburra, o la industria papelera de la ciudad de Cali, la emigración de técnicos creó, en su momento, serios problemas para el desarrollo de dichas industrias.

Desde la perspectiva de los fundamentos del sector privado, las empresas deben transferir este tipo de personal para acompañar su instalación productiva en zonas de bajos salarios, que carecen de alta calificación de recursos humanos (TACHIKI-990 ; FINDLAY, 1990).

Asimismo, las firmas que operan en áreas de alta tecnología tendrían una gran necesidad de movilización de sus cuadros técnicos y científicos, con el objeto de sostener el flujo de intercambio de información acerca de recientes innovaciones (SALT y FINDLAY, 1989).

No obstante, a pesar de la necesidad y ventajas que representan estas transferencias de RHC, y el crecimiento de esta movilidad, recientes estudios sobre compañías multinacionales muestran que, en regiones como Europa, sólo el 0,65 % del total de la fuerza de trabajo de dichas compañías está en situación de expatriado (BREWSTER, 1988). Asimismo, existirían dificultades en transferir técnicas empresariales de un país a otro, y aparecerían diversos problemas en el manejo de gente con distintas culturas (BETBEDER, 1995). Por otro lado, el problema del retorno y readaptación de los cuadros expatriados surgiría también como una limitación a la movilidad de los mismos entre regiones de gran distancia cultural (MENANTEAU, 1995).

Politicas y programas publicos para las migraciones de RHC

Las políticas públicas para los RHC emigrados pueden tener diferentes objetivos, tales como los de retención, regulación o recuperación de los mismos por parte de los países de origen, o de promoción y regulación, por parte de los países de llegada.

Por otro lado, tal como se señaló anteriormente, las políticas desarrolladas desde el sector privado ocupan un papel cada vez más importante.

De acuerdo a la evaluación del costo-beneficio de las migraciones de RHC, los Gobiernos pueden tratar de retener a los potenciales migrantes a través de diferentes programas ; de regular o promover estos flujos, de acuerdo a los requerimientos o disponibilidades de la estructura social del trabajo, o a las demandas u ofertas de los mercados de trabajo ; o bien recuperar esta emigración a partir de programas como los de retorno o vinculación.

Los programas de retención

Con relación a los Programas de Retención, la definición de las políticas está basada en el entendimiento de que los costos de esta migración son más altos que los beneficios, y están orientados a paliar las causas que originan estos desplazamientos. Diferentes determinantes han sido identificadas como causa de las migraciones de RHC. Portes plantea por lo menos tres niveles (PORTES, 1976). El de los determinantes primarios, donde la emigración de élite aparece como consecuencia de los desequilibrios internacionales que permiten a las naciones más desarrolladas ofrecer remuneraciones más atractivas, facilidades de trabajo, mejor standard social y condiciones de vida. Este determinante correspondería al nivel de explicación global de otras tipologías explicativas sobre las migraciones internacionales (MARMORA, 1972). En el segundo determinante, la emigración de profesionales es una consecuencia de los desequilibrios internos estruturales entre la oferta de profesores producida por el sistema de educación de una sociedad y la demanda interna por sus servicios. Este nivel correspondería al definido como génesis de los procesos migratorios, a partir de la problemática de relación entre las formas de producción y los recursos humanos disponibles en tipologías más generales (MARMORA, 1972). El tercer determinante presenta a la emigración de RHC como consecuencia de diferencias individuales debidas, entre otras causas, a la capacitación y habilidades, actual situación y la red de relaciones del individuo.

Si se consideran estos niveles, es claro que cualquier política al respecto debería tener en cuenta, en primera instancia, los desequilibrios económicos estructurales entre los países. En ese contexto, son las medidas macroeconómicas aquellas que podrían dar respuestas de base al problema. Una de las principales propuestas realizadas al respecto en los últimos años, es la de la Comisión para el Estudio de la Migración Internacional y el Desarrollo Económico Cooperativo. Esta Comisión, compuesta por miembros de los partidos demócrata y republicano de los Estados Unidos y creada para examinar los factores que impulsaban la inmigración indocumentada, hacia Estados Unidos, desde países del hemisferio occidental, constituye el mayor y más serio esfuerzo contemporáneo realizado para la búsqueda objetiva de propuestas políticas sobre el tema. Extensas consultas en el exterior y en los Estados Unidos, y un cúmulo de investigaciones académicas llegaron a dos conclusiones fundamentales : por un lado, que la razón principal de este tipo de inmigración es la búsqueda de mejores oportunidades económicas y, por otro, que el desarrollo y el acceso a nuevos y mejores empleos en los lugares de origen es la única forma de reducir gradualmente las presiones migratorias.

Otro tipo de programas en este nivel lo constituyen los que han propuesto el desarrollo de investigaciones conjuntas entre los países desarrollados y los países en desarrollo, con financiamiento de los primeros y utilizando equipos instalados en los segundos. Un ejemplo de este tipo de iniciativa es el acuerdo entre la Academia Nacional de Ciencias de los Estados Unidos y la Academia de Ciencias de Rusia, que está actuando en trece campos científicos (SCHKOLNIKOV, 1992).

Según algunos analistas, como Boussaïd de la Universidad de Argelia, en este tipo de programas puede haber un beneficio doble : los investigadores de los países en desarrollo, a partir de visitas cortas a los países desarrollados, pueden aprovechar sus instalaciones y medios técnicos, mientras que los de los países desarrollados pueden tener un mejor conocimiento de las necesidades y dificultades de los países en desarrollo (BOUSSAÏD, 1994).

La inversión directa para la investigación desde los países más ricos hacia los de menor nivel económico es, en la actualidad, un mecanismo utilizado en casos como el del aporte de la Sociedad Americana de Matemáticas, que designó USD 550.000 en subsidios para matemáticos rusos en su país. O programas similares de la Academia Sueca de Ciencias, destinados a países bálticos, y de otras academias nacionales de ciencias de los países del este europeo. Es de destacar, en este tipo de ejemplos, la Fundación Internacional para la Ciencia en la ex Unión Soviética, fundada por el empresario norteamericano George Soros, con un presupuesto inicial de USD 100 millones de dólares (SCHKOLNIKOV, 1992). No obstante el efecto beneficioso de las políticas y programas de cooperación internacional sobre este problema, es claro que las mismas no pueden sustituir a las políticas nacionales de desarrollo. Estas últimas deben incluir estrategias adecuadas para un mejor aprovechamiento de su mano de obra calificada ya que, de no ser así, la transferencia inversa de tecnología seguirá incrementándose (TAPINOS, 1993).

Otra estrategia que se ha planteado para la retención de RHC es la del incremento de la cooperación horizontal entre países en dsarrollo la cual, teóricamente, tendría efectos en la fijación de éstos en sus países o subregiones. No existen evaluaciones de estos programas en este sentido, pero su dimensión y los beneficios obtenidos por los participantes deberían ser de un nivel considerable para que lograsen estos objetivos.

Algunos autores como Ardittis, consideran que este tipo de programa podría ser exitoso para evitar el éxodo si existiesen medios administrativos en los países que permitieran : a) la elaboración de una relación de profesionales y estudiantes disponibles para CTPD (no sólo en las grandes metrópolis, sino también en las regiones aisladas del país) ; b) la aplicación de un sistema de reclutamiento prioritario para los candidatos residentes ; c) el pago para los que se movilicen, similar al acordado a los profesionales expatriados, y no una reducción de su “per diem”, como ocurre en algunos casos, como los de Sri Lanka o algunas experiencias en Améria latina (ARDITTIS, 1984).

Otras iniciativas orientadas a corregir este desequilibrio causante de la transferencia inversa de tecnología, han sido las del Fondo compensatorio de mano de obra calificada. Este Fondo permitiría, a los países proveedores de RHC, recibir una compensación para programas de desarrollo. Si bien la idea no fue rechazada por la comunidad internacional, diversos inconvenientes, como la falta de estadísticas, o bien la carencia de una definición consensuada sobre qué es un migrante calificado, han sido obstáculos que han hecho imposible, hasta ahora, la constitución de dicho Fondo (D’OLIVEIRA E SOUZA, 1989).

Otra propuesta en el mismo sentido, ha sido la de imponer, sobre cada migrante calificado, un impuesto internacional que debería ser pagado por el país receptor. Las resistencias de los países industrializados y los obstáculos técnicos para su implementación han determinado que esta iniciativa también haya quedado sólo en el terreno de la propuesta (BOUSSAÏD, 1994 ; D’OLIVEIRA E SOUZA, 1989).

En el segundo nivel, ya señalado, de los determinantes de estas migraciones -el de los desequilibrios internos de los países- la retención se ha intentado a través de diferentes iniciativas y programas.

El primer problema que se presenta en este nivel, es el de la cuestión sobre hasta qué punto y en qué condiciones los desequilibrios internos de un país o sus disparidades sociales incrementan la emigración de sus RHC. Autores como Borjas ponen en cuestión esta hipótesis planteando que, en aquellos países con una gran disparidad de ingresos, los individuos con alta calificación tienen ingresos mucho mayores a la media nacional de esos países. A la inversa, en aquellos países donde los ingresos entre las altas y bajas calificaciones son relativamente igualitarios, los RHC estarían más motivados para la emigración (BORJAS, 1987).

Teniendo en cuenta estas consideraciones, la emigración de RHC y, por lo tanto, las políticas y programas para su retención, pueden tener distinta orientación si dicha emigración se da desde países con un grado de pobreza estructural en el que no hay posibilidades de implementar ningún mecanismso de retención ; países en desarrollo con una distribución de ingresos no equitativa, pero altamente favorable a los sectores calificados de la mano de obra ; o bien países industrializados en los que el incentivo económico no constituye una herramienta válida para la retención. En ese sentido, son importantes las observaciones de Grubel y Scott, en su análisis sobre las motivaciones emigratorias de científicos ingleses, donde los factores políticos, profesionales y psicológicos aparecen como más importantes que los económicos (GRUBEL y SCOTT, 1977).

Con el objeto de retener la fuga de cerebros, algunos países han adoptado medidas internas, tales como el aumento de fondos para las instituciones científicas existentes. Si bien este incremento permite generar más y mejores oportunidades de empleo, en algunos casos han aumentado el deficit del presupuesto y la inflación, preservando más las estructuras de organizaciones científicas ineficientes que contribuyendo al bienestar de los científicos.

Por esas razones, algunos Gobiernos han optado por otra estrategia, que es la de orientar su inversión a proyectos seleccionados por su importancia científica y técnica en el contexto del desarrollo nacional (SCHKOLNIKOV, 1992).

La migración temporal de RHC hacia otros países constituye otro tipo de programa apreciado por los países de origen, ya que no sólo permite retener al migrante, sino que el país se beneficia con los ingresos y experiencia del migrante temporal a su retorno.

Por último, la apertura económica y la ampliación de mercados para la colocación de productos de alta tecnología, constituye una estrategia económica nacional que puede aumentar la generación de empleo en estratos de mano de obra calificada de excelencia..

En un tercer nivel, y directamente vinculado con los ya señalados costos y beneficios individuales de los migrantes, pueden señalarse los incentivos materiales a los técnicos y científicos (en forma de créditos o reducción de impuestos), o bien el incremento de posibilidades de ascenso, a veces difícil en los rígidos sistemas académicos de algunos países.

Otro tipo de medida para retener RHC ha sido la utilizada por algunos países, a través de la limitación de visas o pasaportes para sus conciudadanos. Además de la violación al derecho a la libre movilidad, en la práctica estas medidas no han tenido eficacia e, incluso, han incrementado la falta de transparencia (CHONGO MUNDENDE, 1989).

Los programas de regulación y promoción

La regulación o promoción de las migraciones de RHC se dan, en el primer caso, cuando el flujo está establecido y se lo quiere orientar en función de ciertos objetivos, o bien cuando no existe o es insuficiente y se lo quiere atraer en mayor cantidad. Dentro de las políticas de pro-

moción inmigratoria, se pueden mencionar dos tipos : aquellas desarrolladas en forma masiva y las selectivas. Es en el período posterior a la Segunda Guerra mundial, cuando la necesidad de una mano de obra calificada para el desarrollo económico e industrial de algunos países dio lugar a la planificación y ejecución de un tipo de inmigración selectiva : los llamados programas de inmigración de recursos humanos calificados. Estos programas estuvieron dirigidos a la captación de científicos, técnicos e intelectuales, en una primera etapa procedentes de la Europa de post-guerra. Fueron utilizados fundamentalmente por países desarrollados, como Estados Unidos y la Unión Soviética (por ejemplo, para los proyectos espaciales) y, en menor medida, por otros países como la Argentina, Canadá y Australia, donde este tipo de programas tuvo un amplio desarrollo durante las décadas de los ‘60 y ‘70, coincidiendo con el esfuerzo de industrialización que desarrollaron estos paises.

Uno de los instrumentos adoptados para la ejecución de estos programas fue el de los acuerdos bilaterales. Por ejemplo, los de Italia con Bélgica en 1946 y 1947, con Checoslovaquia en 1947, con Francia en 1946 y 1947, y con la Argentina en 1947 y 1948 (ROVIRA, 1950).

Estos programas han podido desarrollarse satisfactoriamente en aquellos casos en que hay una coincidencia de interés entre los países receptores y expulsores. Pero el incremento del “éxodo de competencias” desde los países en vías de desarrollo y los intentos de los mismos para evitar esta emigración, han actuado de contrapeso y muchas veces frenado estos programas, cuando los mismos implicaban un traslado de recursos humanos calificados desde estos países hacia los desarrollados.

A pesar de la generación de este tipo de situaciones, los programas de migración de recursos humanos calificados han tenido una fuerte incidencia en el desarrollo de paises, como es el caso de los latinoamericanos. Su desarrollo ha estado a cargo de organismos internacionales como el ex-CIM (actualmente OIM), que a partir de 1964 inicia sus acciones en este sentido.

Bajo este Programa la OIM analiza en sectores prioritarios de los países interesados cuáles son la tareas específicas para las que se necesitan recursos humanos calificados. Estas necesidades se comunican a las oficinas de la OIM en Europa, en las que tiene lugar la preselección profesional, reclutamiento, orientación y asesoramiento de los candidatos.

Para el eficaz desarrollo de este Programa la OIM ha establecido un “Fondo de Compensación” para que, en casos de necesidad, pueda otorgarse asistencia financiera complementaria a los inmigrantes durante el período inicial de su asentamiento. El apoyo se hace a través de subsidios salariales, asignación por número de dependientes y gastos de instalación, y los importes son ajustados sobre la base de las calificaciones de los candidatos, composición del grupo familiar, oportunidades de promoción y remuneración que se les ofrece en el país de acogida.

Otro mecanismo que la OIM utiliza para asegurar la migracion, es el procedimiento llamado “Asistencia para la Integración”, mediante el cual se otorga un seguro de salud durante el período inicial y se brinda colocación en casos de urgencias imprevistas. Dentro de estos programas, desde 1964 hasta 1988 la OIM trasladó alrededor de 27.000 migrantes europeos calificados. A su vez, con el objeto de mejorar la información sobre requerimientos y disponibilidades de recursos humanos calificados que tienen los paises latinoamericanos, la OIM realizó un análisis en los países de la región sobre los diferentes sistemas de información que cada uno de ellos tenía sobre el tema (MARMORA, 1983).

En las actuales políticas de migraciones internacionales, prácticamente todos los países de inmigración, aun los más restrictivos, están abiertos para la entrada de RHC. Australia, Canadá y los Estados Unidos han incrementado el número y la proporción de RHC en sus contingentes de inmigración. Según algunos autores, este tipo de política es el que explica, en una gran parte, el incremento de “transferencia inversa de tecnología” en las últimas décadas (CHEN CHIN LONG, 1989)

Australia, bajo la influencia del Informe Fitzgerald, se ha propuesto escenarios para el año 2031, en los cuales se prevé un aumento de la inmigración calificada (APPLEYARD, 1991). Canadá ha desarrollado una legislación abierta para los migrantes que entran en la categoría de "independientes", a partir de una selección por educación y habilidades, promoviendo asimismo de una manera activa, al igual que Australia, la inmigración de empresarios e inversionistas con capital.

Canadá inicia sus programas bajo el nombre de Inmigrantes Empresariales, a través del Acta de Inmigración de 1976 y las Normas de Aplicación de 1978. Hacia 1990, el 8.5 % de los inmigrantes recibidos por este país obtuvieron sus visas dentro del Programa Empresarial. Si bien no está definido el capital que debería traer el inmigrante, se estiman montos de Cnd$ 250.000 en pequeñas ciudades y Cnd$ 500.000 en las grandes. En 1986 se incorporó dentro de estos programas la categoría de inversores, para los cuales se establecieron cifras mínimas de inversión entre Cnd$ 250.000 y Cnd$ 500.000, según provincia ; con períodos de inversión (el tiempo en el cual el capital no se puede retirar) de 5 años, y patrimonios netos entre Cnd$ 500.000 y Cnd$ 700.000.

En 1985, el Comité Parlamentario para el Trabajo, Empleo e Inmigración inició una revisión exhaustiva de estos programas. A partir de dicha revisión se efectuó una serie de modificaciones tendientes, básicamente, a simplificar el acceso a Canadá de los empresarios calificados ; a dar a la Comisión de Empleo e Inmigración de Canadá (CEIC) y a las provincias, la oportunidad de entrar en contacto directo con los empesarios para suministrarles información y asesoramiento, asistiéndolos en la instalación personal y de sus empresas, y permitir a la CEIC el control sobre el cumplimiento de los requisitos de admisión. Actualmente, los empresarios deben presentarse cada seis meses para verificación de los requisitos (MASSEN, 1994).

En el caso de Australia, se lleva a cabo un programa de "Migración Empresarial", por el cual ingresaron a este país, entre 1982 y 1990, un total de 36.555 personas. A partir del análisis efectuado en 1991 por una Comisión Parlamentaria, se introdujeron en este programa modificaciones tales como el monitoreo obligatorio a los 12 y 24 meses de llegada al país, un sistema de información sobre las dificultades que los migrantes tuvieron para insertarse en la actividad empresaria en el país ; la abolición del sistema de gestores acreditados y el establecimiento de un sistema de puntajes para la admisión, basado en la aptitud empresarial, la edad, el conocimiento del idioma y el capital a invertir (MASSEN, 1994).

Como ejemplo de este tipo de programas promovidos por organizaciones internacionales, son de señalar los "Programas Agrícolas" de la OIM, cuyo objetivo es el de asentar, en América latina, agricultores con capital. Su plan de acción se desarrolla a partir de dos esquemas operativos : a través de la asistencia a los agricultores u organizando pasantías de los mismos en los posibles lugares de asentamiento.

En los Estados Unidos de América, la apertura para los RHC tiene un punto de inflexión con el Acta de Inmigración de 1965, a partir de la cual el factor calificación se impone como predominante en los criterios de admisión de inmigrantes. Gran Bretaña logra, a partir de la década del 80, atraer las competencias que considera necesarias gracias a su sistema de permisos de trabajo. El Japón ha modificado sus leyes migratorias para poner freno a la inmigración clandestina, pero también para promover la inmigración calificada, en particular la proveniente de Filipinas y Tailandia (FINDLAY, 1995).

Dentro de la regulación de los movimientos migratorios de personal calificado, es importante considerar el incremento de los mismos vinculado con la cooperación técnica internacional, ya sea bilateral o multilateral.

Los sistemas de consultores y expertos asociados o integrados establecidos por los países desarrollados para cooperar con los países en desarrollo, o los programas de cooperación horizontal entre éstos, constituyen un fenómeno creciente en el marco de la migración temporal de RHC.

Este último sistema de cooperación se ha incrementado en los últimos años, destacándose su actividad en regiones como la de América latina. Entre otros países de la Región, Colombia, Argentina y Chile pueden señalarse como ejemplos de este tipo de cooperación mediante la movilidad de RHC.

En 1978, bajo el auspicio del sistema de las Naciones Unidas, se establece el Plan de Acción de Buenos Aires, donde se plantean los objetivos y las líneas de actividades de este tipo de cooperación.

Colombia crea, en 1989, el Fondo de Cooperación y Asistencia Técnica para Centroamérica y el Caribe y, en 1991, institicionaliza la CTPD en su Constitución. El avance de sus acciones en los últimos años han involucrado en la Región, y en forma bilateral, a países como la Argentina, Brasil, Chile, Honduras, Costa Rica, México, Venezuela, Jamaica, Guyana y Surinam. Asimismo sus actividades de CTPD se han extendido a países de Europa del Este, como Hungría y Rumania, y a Africa, en la Región del Maghreb Arabe y la República Federal de Nigeria. En 1994 se inicia un ejercicio de cooperación triangular con los Gobiernos de Italia y El Salvador.

Chile está desarrollando un amplio programa de CTPD con diversas regiones geográficas del mundo, a través de su Agencia de Cooperación Internacional (AGCI), en dos áreas básicas definidas como científica-tecnológica-productivas y organizacionales. El financiamiento de las misiones de CTPD es realizado con el sistema de fondos compartidos con el país demandante de la misma.

En el caso de la Argentina, el Gobierno de este país ha destinado alrededor de USD 20 millones, en los últimos diez años, a programas de CTPD. En la actualidad, tres Fondos de dicho Gobierno están destinados a esta actividad : uno con la OEA de un millón de dólares ; otro con el PNUD, de dos millones ; y otro con la OIM, de cuatro millones.

Durante 1995, a través del Fondo CTPD del Gobierno Argentino con la OIM, se ejecutaron alrededor de 400 acciones de cooperación. La mayor parte de ellas, en la región latinoamericana, destacándose también otras acciones en países como Argelia, Bulgaria, Guinea Ecuatorial, Rusia, Senegal, Túnez y Ucrania. En cuanto al tipo de actividad de este CTPD, el 70 % correspondió a consultorías ; el 20 %, a pasantías de capacitación en la Argentina ; y el 10 % a Seminarios. Con respecto al sector de aplicación, un 31 % de las acciones estuvieron dirigidas al sector de políticas públicas ; otro 31 %, al de ciencia y técnica ; un 22 %, al sector productivo ; y un 16 % al de servicios.

Los programas de recuperación

La recuperación de los RHC emigrados constituye uno de los objetivos de las políticas de aquellos países (de origen o de llegada) que se implementa normalmente a través de dos tipos de Programas : los de retorno y los de vinculación.

El retorno de emigrados tiene como objetivo su reinserción posterior en el lugar de origen. A este respecto, debe distinguirse la situación de los trabajadores que se expatriaron por razones económicas y sociales, de aquella migración, frecuentemente de altas calificaciones, que lo hizo por razones políticas o culturales.

En algunas situaciones, el retorno es promovido por el país de origen, con el objeto de recuperar capital humano emigrado ; en otros casos, la iniciativa proviene de los países de destino, los cuales facilitan la repatriación como forma de descompresión de sus sociedades y mercados de trabajo.

Un número considerable de emigrados retorna espontáneamente después de haber acumulado un cierto capital, pudiendo usar su experiencia y aplicar sus ahorros en sus propios países para

emprender alguna actividad productiva. En otros casos, los gobiernos de los países de destino han instrumentado regímenes para facilitar el regreso de esos trabajadores. Una situación diferente es el retorno de profesionales calificados y de exiliados por razones políticas.

En el caso especial de América latina, en varios países hubo éxodos masivos durante los regímenes militares de las décadas del 70 y 80. Ejemplos de ellos son las emigraciones de los últimos quince años. En la Argentina, entre 1970 y 1985 habría emigrado entre el 0,98 y el 1,3 % de la población y, en Uruguay, ese porcentaje se ubicaba entre el 10 y el 13 % (MARMORA-GURRIERI, 1988).

En América Central, los desplazados y refugiados oscilaron entre 250.000 y 600.000 en Guatemala ; 350.000 y 500.000 en Nicaragua, y 1.100.000 y 1.600.000 en El Salvador (WEISS FAGEN y AGUAYO, 1988). Con el restablecimiento de los regímenes democráticos, la mayoría de los exiliados retornó aunque, en general, no existieron mecanismos eficientes para instrumentar la repatriación.

Sobre el retorno y la reintegración de migrantes calificados existen programas internacionales que han logrado significativos avances en este objetivo, tal como el ejecutado por la OIM a pedido de los Estados miembros. Este programa se basa en el concepto de que las migraciones internacionales pueden constituir un importante elemento de la evolución social y económica y una parte del proceso evolutivo de los países en desarrollo (PIRES, 1992).

En América latina, entre 1970 y 1989, logró el retorno de 11.554 personas a sus países de origen (OIM, 1990). En el programa de la OIM para Africa, durante su primera fase (1983-1987), se prestó asistencia a 568 nacionales de países africanos para su regreso ; en la segunda fase, hasta marzo de 1992 se había facilitado el retorno y reintegración de 730 nacionales de países africanos (los de mayor afluencia fueron Zimbabwe, Kenya y Ghana). Además la OIM, con financiamiento del gobierno del Japón, ha emprendido programas de retorno a Afganistán y a Camboya (PIRES, 1992).

Estos programas se inscriben en el contexto de las políticas de incorporación, y su objetivo es el de la repatriación de nacionales, selectiva o masiva, desde el exterior ; una acción conjunta coordinada entre los países de acogida y los países de origen.

Entre las medidas que podrian aplicar los países de acogida, deberían considerar favorablemente, el suministro de apoyo técnico, administrativo y financiero para el establecimiento de trabajadores retornados. En cuanto a los países de origen, podrían prestar asistencia mediante la compilación de informaciones más detalladas sobre el retorno (OIM, 1985).

En estos programas se pueden diferenciar tres temas que no sólo son distintos, conceptual y operacionalmente, sino que, en general, se presentan cronológicamente separados : la previsión del retorno, la asistencia de emergencia y la inserción sociolaboral (MARMORA, 1989).

Los programas de vinculación con la población emigrada forman parte de las políticas de recuperación y tienen como objetivo efectivizar los vínculos entre los nacionales que viven fuera del país de origen y la sociedad de dicho pais.

Su planteo y desarrollo parte del supuesto de que la emigración puede representar no sólo pérdidas sino también beneficios para el país, si la misma es aprovechada en sus aspectos positivos.

Los programas de vinculación están conformados por dos aspectos básicos : los motivacionales y los operacionales.

Los primeros, orientados a incentivar las conductas de los emigrados para que adopten decisiones que beneficien al país ; y los segundos, encargados de proveer los canales necesarios para que esas decisiones brinden beneficios al pais de origen (MALETTA, 1988).

El primer componente es imprescindible para que el segundo tenga vigencia. Dentro de los aspectos motivacionales de estos programas, se pueden identificar aquellos que hacen a la par-

ticipación electoral, a la política de ciudadanía, la comunicación e información sobre el país de origen, y la política educacional dirigida a los emigrados.

En cuanto a los aspectos operacionales de estos programas, son de señalar : los de cooperación científica, técnica y tecnológica ; la cooperación empresarial ; la cooperación humanitaria, y los flujos económicos privados.

La cooperación científica, técnica y tecnológica constituye un elemento fundamental para la « transferencia de conocimientos y tecnología », necesaria en muchos países de origen para su desarrollo económico social.

De acuerdo al esquema propuesto por Maletta, las principales formas que puede adoptar esa cooperación y que, de hecho, se dan en forma espontánea, son las siguientes :

- Visitas frecuentes al país para participar en seminarios, congresos, cursos y otros eventos con colegas y estudiantes de su pais. Un ejemplo de este tipo de actividad es el Programa TOK-TEN, que comenzó en 1976 a iniciativa del Gobierno de Turquía y del Programa de las Naciones Unidas para el Desarrollo. Su objetivo principal es el de aprovechar los conocimientos especializados de los nacionales expatriados, a fin de que contribuyan al desarrollo de sus países de origen.
- Acogida de estudiantes de postgrado, dirección de tesis a distancia para estudiantes radicados en el país de origen, canalización de información sobre becas y otras posibilidades de apoyo a la formación de jóvenes científicos.
- Desarrollo de proyectos colaborativos de investigación con científicos radicados en su país de origen, con fuentes de financiación tanto nacionales como extranjeras. En particular, asociación de científicos del país de origen a proyectos que gozan de financiaciones no accesibles directamente en el país.
- Fomento de la dedicación de científicos en el exterior a temas que son prioritarios para su país de origen.
- Establecimiento de redes horizontales de cooperación e intercambio de información científica, entre científicos emigrados y científicos no emigrados. (MALETTA, 1988).

En lo que hace al impacto de estas diferentes líneas de cooperación, existen sobre la “fuga de cerebros”, algunas evaluaciones referidas específicamente al Programa TOKTEN. En ese sentido, dos preguntas básicas se han planteado respecto de dicho Programa : ¿Puede promover el retorno definitivo del RHC emigrado ? ¿Puede sustituir de alguna manera al personal técnico emigrado ?

Sobre la primera, un análisis realizado sobre 700 consultores -movilizados por TOKTEN entre 1977 y 1983- permitió observar que sólo dos casos eligieron el retorno definitivo (ARDITTIS, 1984). En ese sentido, cabe acotar que el TOKTEN no ha tenido como objetivo específico el retorno.

Con relación a la segunda pregunta, las respuestas giran alrededor de la posible complementariedad existente entre los requerimientos específicos del país de origen, en un momento determinado de su desarrollo, y la disponibilidad efectiva que puede haber de esos RHC en el “pool” de los RHC del Programa (ARDITTIS, 1984).

En cuanto a la cooperación empresarial, es de señalar que la existencia de una comunidad emigrada en distintas partes del mundo facilita para el país el acceso a mercados de exportación, así como a mercados de capitales y tecnología, mucho más amplios que los del propio país de origen.

En una economía cada vez más interdependiente, la existencia de individuos con experiencia o talento empresarial residentes en el exterior es un activo de enorme valor para un país que desee incrementar su presencia en los mercados internacionales. (MALETTA, 1988).

A su vez, el conocimiento de los mercados de exportación de bienes del país de origen, y el acceso a mercados de capitales otorga a los emigrados una posición de privilegio, tanto como

agentes de exportación como para el acceso a capitales de riesgo o al crédito bancario internacional para iniciativas generadas en el país de origen.

Con relación a la cooperación humanitaria, ésta puede implementarse a través del establecimiento de canales que permitan el apoyo a sectores carenciados del país de origen, por parte de emigrados o de asociaciones de éstos establecidas en los lugares de acogida. Otros sectores receptores de esta cooperación pueden ser las instituciones educacionales o científicas del país de origen, recibiendo equipamiento y bibliografía destinadas a la investigación y la docencia.

Estas ayudas pueden transferirse a través de organismos gubernamentales y no gubernamentales. El apoyo puede traducirse en acciones concretas como, por ejemplo, proyectos de ayuda a escuelas o centros de salud en zonas marginales, apoyo a planes de nutrición materno infantil, atención individualizada de niños carenciados mediante programas de apadrinamiento, etc.

Tales posibilidades pueden canalizarse a través de diferentes instituciones, tomando como base propuestas de entidades gubernamentales o no gubernamentales. Se deberían prever mecanismos para el envío de materiales o de dinero como parte del proceso de ayuda. Los residentes en el exterior, y en especial los RHC, pueden no sólo movilizar su propia contribución financiera personal sino también canalizar eventuales fondos institucionales disponibles en su país de residencia, y que no son fácilmente accesibles desde las zonas afectadas ni suelen tener al país de origen en sus listas de países prioritarios.

Por último, en cuanto a los flujos económicos privados, ya sea en forma de remesas o de repatriación de activos fijos, estos podrían ser activados a través de regímenes de excepción ante disposiciones limitativas cambiarias, tributarias o aduaneras.

Politicas y programas privados para las migraciones de RHC

La movilización de RHC por parte del sector privado está compuesta de políticas y programas en función de los intereses y estrategias de estos sectores, y no necesariamente pueden coincidir con las políticas públicas. Es un hecho reconocido que se está lejos de saber en qué medida las políticas públicas sobre el tema afectan a las medidas tomadas por las empresas multinacionales en el campo de las estrategias de transferencia de competencias y de valorización de recursos humanos que ellas tienen en sus propios mercados internos de trabajo. En ese sentido, Findlay recomienda que los países en desarrollo deben tratar de aprovechar las migraciones de RHC en las multinacionales, para intensificar las transferencias de tecnología y encontrar el medio de impedir que los cuadros profesionales extranjeros sólo se contenten con “alquilar” sus competencias de manera temporaria (FINDLAY, 1993).

Las políticas de las empresas privadas en este contexto han tenido diferentes cambios en el tiempo, pasando por una serie de etapas (LEBAUBE, 1995).

En un primer momento, en la época de las colonias europeas, especialmente en Africa, los expatriados eran enviados por largos períodos fuera de su país. Alejados de su sede durante casi toda su carrera estos cuadros eran, en general, incapaces de reintegrarse profesionalmente a sus países de origen.

En los años 70 se establece una movilidad internacional diferente. Era necesario hacer coincidir la capacidad de los cuadros profesionales con la posibilidad de trabajar en cualquier lugar del mundo ya internacionalizado en intercambios comerciales. Equipos de profesionales se asentaban en las subsidiarias para instalar sistemas de producción y organización. Las empre-

sas tenían al respecto una visión de “corto término”. El recurso de la emigración de RHC hacia lugares donde no se encontraban expertos locales era el medio más fácil para asegurar la base logística en cada sitio (BEUVE-MÉRY, 1995). El expatriado va a contar, en esta etapa, con toda suerte de incentivos, tales como alojamiento, autos, primas, etc. Con este sistema, la expansión de las empresas resultaba costosa, económica y humanamente, al momento del retorno, debido al alto nivel que gozaba el expatriado en el exterior.

En los 80, las empresas van a cambiar de políticas en función de las exigencias de la restructuración. Limitan, por razones económicas, el movimiento de expatriados, y cambian las características de los mismos. En lugar de enviar a cuadros experimentados, comenzaron a expatriar a jóvenes profesionales con el fundamento de que la experiencia en el exterior podía mejorar su formación.

En la actualidad, se observaría una reapertura de la movilización de cuadros. Mayor que la de los 80, pero menos generosa que la de los 70. La migración de los RHC en el contexto de las compañías transnacionales se va a desarrollar de una forma menos excepcional pero más integrada a las estrategias y cultura organizacional de las firmas (LEBAUBE, 1995). En la medida en que se desarrollan, las grandes firmas se han especializado y sus relaciones internas se han hecho más complejas. Las migraciones de RHC constituyen una de las manifestaciones de esas relaciones internas.

Las estrategias de las empresas, sobre todo cuando eligen entre la expansión horizontal y la integración vertical, va a repercutir en sus estructuras y, por lo tanto, en el movimiento de su personal.

En el caso de empresas organizadas según los principios “orgánicos”, con tecnologías de punta, con innovaciones constantes, son necesarios especialistas capaces de desplazarse rápidamente (SALT y FINDLAY, 1989).

De esta forma, la estructura de los movimientos migratorios de RHC va a depender de las políticas de las empresas en cuanto a la distribución espacial de sus actividades, así como a sus preferencias en materia de distribución geográfica del trabajo. Una de las principales razones para realizar estos movimientos consiste en que, con el desplazamiento de su propio personal, la empresa protege su superioridad técnica y sus avances en investigación.

De acuerdo a la región o país adonde va el expatriado, serán sus ventajas. Se prefiere la movilización de RHC pertenecientes a la misma región geográfica, ya que las dificultades de integración al medio -a pesar o a causa del microambiente cultural en que normalmente se desarrollan sus vidas (KING, 1976)- van a ser evaluadas especialmente por las empresas (MENANTEAU, 1995).

Las empresas transnacionales adoptan cada vez más los sistemas internacionales de clasificación por empleos, con una grilla de salarios de acuerdo a cada puesto de trabajo. Un conjunto de servicios son ofrecidos al RHC desplazado para facilitar su asentamiento, tales como de búsqueda y alquiler o compra del alojamiento, y trámites administrativos de todo tipo para su instalación y la de su familia.

En este contexto, los mercados de trabajo y las demandas generadas por éstos se van a cubrir con transferencias dentro de las mismas empresas más que a través de la “libre competitividad” (FINDLAY, 1993). Los flujos de mano de obra calificada van a estar cada vez más signados por aquellos que determinan la estructura de la producción a escala mundial, o por las oficinas internacionales de reclutamiento (SALT y FINDLAY, 1989) que por las medidas de apertura o restricción de las políticas públicas (GOULD, 1988).

A pesar de estas políticas para la movilidad de sus cuadros, existiría evidencia sobre el hecho de que algunas compañías estarían tendiendo a reducir el movimiento de sus RHC, utilizando otras estrategias, tales como las “joint ventures” (utilizando expertos locales) o la creciente contratación de servicios especializados (KEEBLE, BRYSON y WOOD, 1991).

Conclusiones

El aumento de los movimientos de RHC, correspondiente a la creciente transnacionalización de la economía y otros factores asociados, ha dado lugar a distintas reflexiones sobre la validez de diferentes conceptos asociados a esta problemática.

En principio, puede observarse que los distintos conceptos, en lugar de anularse, se superponen y coexisten en los actuales procesos migratorios. Sigue existiendo la "fuga de cerebros" ; la "transferencia inversa de tecnologías" se ha incrementado, acompañando la brecha creciente entre el mundo desarrollado y el mundo en desarrollo ; y los "intercambios de competencias" han tomado una dimensión cada vez mayor, tanto en las esferas públicas de cooperación internacional, como en los espacios privados de las transnacionales.

Se constata que los efectos de las migraciones, en general, y de los RHC en particular, tienen a corto plazo un beneficio para los países de origen en términos de descompresión de los mercados de trabajo con excedentes de oferta, y de ingresos por parte de las remesas enviadas por los migrantes.

Asimismo los países de recepción se ven favorecidos por un flujo permanente y en incremento de un capital humano cuyos costos de reproducción han sido efectuados por los países de origen.

A mediano plazo, la escasez de RHC puede afectar negativamente las posibilidades de desarrollo de los países de origen ya que, como se ha comprobado en algunas economías emergentes, la existencia de RHC no es una consecuencia, sino un prerrequisito para el crecimiento económico en las actuales condiciones del mercado internacional.

Con relación a las políticas públicas para las migraciones de RHC, se pueden observar diferentes estrategias vinculadas a los objetivos de retención, regulación, promoción o recuperación de esta clase de migrantes.

Las políticas de retención de los RHC, como cualquier otra de este tipo, dependen en primera instancia de la posibilidad de modificación de aquellos factores estructurales que brindan mayores posibildiades para los RHC en los países desarrollados. Programas específicos para un mejor desenvolvimiento profesional y nivel de vida de los RHC, a través de acuerdos bilaterales o medidas de fomento e inversión interna en sectores de alta tecnología, así como subsidios especiales para el área científica, están siendo implementados en la actualidad con el objetivo de retención de personal calificado.

La regulación y promoción de inmigración calificada constituyeron la base de las políticas migratorias de los grandes países receptores en las últimas décadas. La restricción selectiva es la estrategia migratoria que han adoptado países como los Estados Unidos, Canadá y Australia, así como algunos países europeos devenidos receptores de migrantes luego de la Segunda Guerra mundial.

Dentro de los programas de regulación de la movilidad de RHC, es importante destacar el incremento de la cooperación técnica internacional y, en especial, de la cooperación técnica horizontal entre países en desarrollo que, en el caso de la región latinoamericana, ha adquirido una creciente importancia.

En cuanto a la recuperación del migrante calificado, dos programas han sido desarrollados con relativo éxito en las últimas décadas : los de retorno y los de vinculación. Los primeros han logrado cierto éxito selectivo en regiones como Africa y América latina. Con respecto a los segundos, son de destacar la experiencia del Programa TOKTEN, así como otras iniciativas que están incrementando la utilización de los RHC instalados en el exterior, en función de necesidades detectadas por parte de sus países de origen. Si bien el efecto de estos programas sobre el retorno no ha demostrado ser efectivo, el hecho de movilizar estos recursos humanos en términos de una cooperación técnica constituye, como algunos autores han señalado, pasar del "pasivo al activo" en esta materia.

Por último, es fundamental incluir, en el panorama de políticas sobre este segmento de las migaciones, las realizadas por el sector privado.

Diferentes etapas del desarrollo productivo y de organización de las empresas transnacionales han determinado distintas estrategias en la movilidad de sus RHC.

En la actualidad, podría decirse que dicha movilidad depende mucho más de las decisiones de relocalización de los cuadros profesionales de estas empresas, que de las eventuales políticas de restricción o de promoción que puedan adoptar los Gobiernos.

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International Migration of Highly Qualified People: a Bibliographic and Conceptual Analysis

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Jacques Gaillard

Establishing the data base

We present in this introduction the criteria adopted to select the references, as well as the different sources and methods used to establish our bibliographic base.

Selection Criteria

The selection criteria that we have chosen aim at listing the works relating to the migration of intellectuals, scientists and technicians. However, with the desire not to exclude from our base the general and theoretical studies on the brain drain problem, our first selection was made on the key words: brain drain, reverse transfer of technology, while accepting the fact that these concepts, although they constitute the intellectual, scientific and technical migrations, have evolved and have extended during a period that can be situated from 1974 to 1987, to all migrant qualified professions originating from countries of the south. From this selection only 300 titles come out (298).

The remaining references are selected on the basis of professional categories. In this field we have demarcated a good number of previous studies (specially bibliographic) which, when studying the brain drain and the qualified migrations (or of talents) include into the “brain” category people whose qualifications are lacking in the countries of emigration and benefit the immigration countries. Thus, some studies incorporate even skilled labor or certain categories of employees considered as skilled labor (which they really are) and whose lose causes serous damage to the country of origin [1]. They are not included in this base.

Identifying from the professional categories the migrations of highly qualified personnel, and in the context of an international study, was challening. Indeed, the professions and social categories, when clearly delimited (which is not always the case in the studies performed) prove to be non-homogeneous and therefore incomparable since they do not come from the same work history, do not correspond to the same social protection system (which has shaped the concept of category belonging in certain countries), and are not derived either from the statistical analysis. In this matter, certain concepts and words are untranslatable. As an example the french word “cadre” does not have an equivalent in English or German and the English word “professional” can not be translated into French (Desrosières and Thèvenot, 1988). This partly explains partly the variability of the classifications used by each and everyone and justifies the delimitation here of a category called “intellectual, scientific and technical”, taking as their common characteristic the attendance of a university or the so called higher education institutions.

However, while wishing to focus this work on the problem of high level migrations within the geopolitical contexts which have been proper of these migrations, we have eliminated a large number of studies that could be illustrative, but the central problem of which is not connected to migration. Thus, we have excluded studies that refer to national scientific communities or national professional practices or contexts (for physicians, for example), even if these studies anticipate situations favorable to migrations or brain drain.

We did not keep either studies regarding higher education or research national equipements even if we thought they formed a part of internationalization attempts. The same we did in regards to national and international programs in favor of academic exchanges (the latter being very frequently descriptive). But, on the other hand, we kept the studies that examine migrations or exchanges that may have occurred within the framework of these teams and these programs, as well as the evaluation reports of which we had knowledge.

Also, we eliminated a large number of studies dealing with student migration : those referring to the academic success, equivalence problems, linguistic problems, practical guides, description of program courses and of inter-university cooperation, as well as the studies related to recruitment, admissions, specific academic and social teams of these students environment (advisory services, among others). We have not kept either the studies dealing with “the nebulous problems of the needs of foreign students” (Altbach and Lulat, 1985 : 32) : problems of lodging, finances, health, recreation, etc., we did not consider these as central in our migration issues.

Nor did we not keep either the studies that did not deal with migrations but in the legal aspect (which does not imply that this aspect is not dealt with in a good number of selected studies). The psychological and anthropological studies were also disregarded and we did not keep the studies related to small communities that examine the evolution of an identity (proper, ethnic or cultural) or individual and collective matters connected to migration situations (mental diseases of students of such or such nationality in such field, food habits of the group, changes of perception of the role of women or men among Asian nationals in a certain state of the United States, etc.[2]). However, we kept a certain number of studies regarding the adaptation and integration of communities and on cultural problems when these studies had a general nature or when they were directly related to the choice of returning to one‘s homeland or remaining in the host country.

Collection of references

The collection of documentary reference was made first made from several bibliographic studies on the subject of scientific migrations (Glaser, 1978 ; Altbach et al., 1985 ; UNCTAD, 1987 ; Todisco, 1993) and a more general bibliography on the return of migration (Gaillard, 1994). It was then followed by queries to the databases (see Chart No. 1) and the consultation of catalogues of the documentation centers visited (see Chart No. 2). Then, we systematically verified the bibliographic references of the articles and studies consulted. The latter “harvest” was proved to be surprisingly fruitfull despite the systematic condition provided to the previous consultations of the bibliographic studies and the mentioned databases. Finally, we requested some authors among those most prolific (including institutional authors) to complete the reference lists related to them.

1808 bibliographic references were altogether selected. Even if we believe that we have gathered most of the studies published on the subject of international migration of highly qualified people, we do not pretend to have made an all-inclusive study.

Chart No. 1- Questioned Databases

- CLASE: Citas Latinoamericanas en Ciencias Sociales y Humanidades (Mexico)
- FRANCIS - CNRS (France)
- Dissertation Abstract International (USA)
- Répertoire National des Thèses (France)
- LABORDOC Databse of Bureau International du Travail (Switzerland)
- Magazine Database (USA)
- MEDLINE (USA)
- Social Science Index (USA)
- Sociological Abstracts (USA)

Chart No. 2- Libraries and Documentation Centers Consulted

- Library of Congress (Washington D.C., USA)
- Library of Georgetown University (Washington D.C., USA)
- Documentation Center of the International Labour Office (Paris, France)
- Documentation Center of the International Association of Universities (Paris, France)
- Documentation Center of CIEMI (Paris, France)
- Documentation Center of Unesco

Presentation of the base

More than 4/5 of the references are published through various ways (see Chart No. 3). Among the latter the articles published in scientific journals are the largest number (672 references). They are following in order of importance by the contributions in collective studies or communications of conferences (368 references), by institutional reports (189 references) and by books (129 books among which 22 proceedings of meetings and 12 collective works) ; 68 are articles published in information magazines and 61 articles in scientific disclosure magazines. Among the non-published texts are mainly the research reports (mainly thesis the majority of which have never been published) and the reports from national and international institutions and NGO's.

Chart No. 3- Nature of indexed studies

1487 Textes publiés
- 672 articles of scientific journals
- 368 contributions in collective studies or communications conferences
-189 institutional reports, from experts, from NGO´s or from scientific societies published as such
- 129 books (among whch 22 proceedings of meetings and 12 collective works)
- 68 articles of information magazines
- 61 articles in scientific disclosure (Science, Nature, ... etc.)
Texts not published
- 127 resarch reports (among which 10 3 proceedings and theses)
- 97 national reports (amonmg which are communications to meetigns not published)
- 57 reports from experts of international organizartions
- 27 reports of NGO´s
- 13 Miscellaneous

Among the languages used, English (with 1607 references, that is 88 %) is widely dominant. It is a general data of scientific production around the world. Despite the fact that we have questioned several databases or documentation centers in France, the number of papers written in French represents only 112 references (that is, around 6 %) [3]. Next are Spanish and some texts in German, Portuguese and Italian.

The 672 articles published in scientific journals are dispersed in at least 354 titles of which 265 have only published one article, 46 magazines have published 2 articles, 13 have published 3 articles, 6 have published 4 articles, 8 have published 5 articles and 16 have published more than 5 articles (among them two special issues).

Chart No. 4- The “Big magazines” in the field are:

- International Migration which published 30 titles throughout the period with three outstanding publication peaks: 76-77 (5), 85-86 (7) et 91-92 (7);
- Studi Emigrazione/Etudes Migragions which has published 21 articles since 1989, (15 in a special issue dedicated in 1955 to the publication of the proceedings of meetings on migration of qualified personnel);
- Minerva with 20 articles published, more than half before 1975, with a slight increase since 1990 (4 articles);
-International Educational and Cultural Exchange, with 20 articles published from 1966 to 1978;
- International Migration Review with 16 articles published mainly during the first half of the 70´s and since 1990;
- Comparative Education Review with 13 articles (among which more than half -7- were published in 1984).

The scientific fields covered by the journals are mainly those of human sciences (mainly anthropology, demography, economics, geography, history, psychology, educational sciences, communication sciences, political sciences and sociology) but the subject of the mobility of scientists and academic personnel is also of interest from time to time to the researchers of “hard” sciences such as physics, biology and medicine, whose articles published in the specialized journals mainly deal with the subject of brain drain [4]. This concern by the researchers of “hard” sciences is evident, but if the article represent but a small portion of the articles of scientific journals (47 articles in 33 magazines), it is necessary to add 54 articles published in scientific disclosure magazines (Science, Nature, New Scientists, for example) [5].

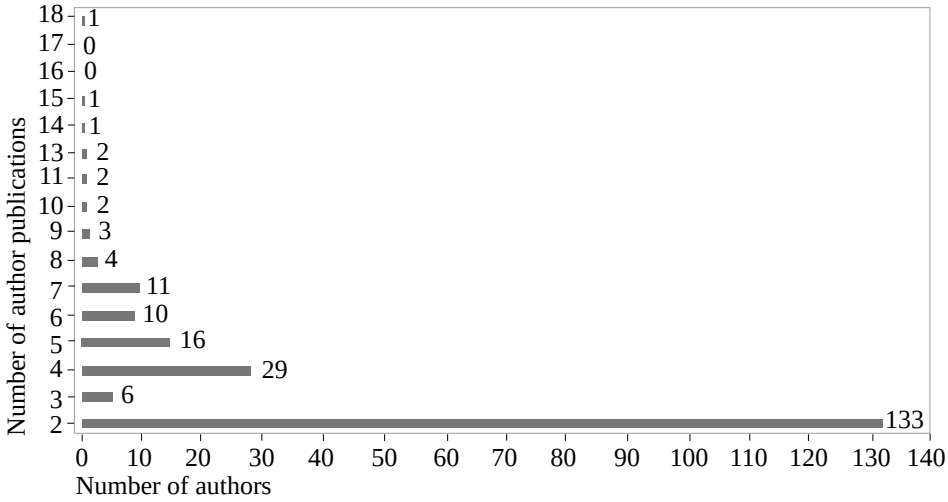
However, the magazines of multi-disciplinary subjects are the ones that gather the largest number of references, sarting with those that are specialized in the study of migrations and then those that deal with science and education.

The authors, who amount to 1,597 (among them 150 institutional authors), often happen to be people who have published alone. In fact, only 294 references are the result of collective work, among which 221 are signed by two authors.

In addition, these are authors who in an overwhelming majority (84 %, that is, 1,181 people) have only made one publication on this subject. This would tend to prove that there is not a multitude of specialists in the field under examination. Thus, for example, it is observed that only 13 authors of university thesis (on the 103 selected in the base) have made publications on the subject of the thesis subsequent to the latter. In addition, the vast majority of these thesis was never published and can only be located in specialized databases.

However, it is necessary to avoid the inverse reasoning and to think that the experience of the author grows systematically with the list of his publications. If there probably is most of the time a convergence between the former and the latter, we will only consider here the quantitative

observations. Indeed if the frequency of the publication is a relevant indicator to be emphasized in a bibliometric analysis, it will be sufficient to look at the titles of the work by certain authors to understand that experience can not only be detected by the number of publications, and that these are sometimes the more or less hidden results of an initial text rearranged as time went by. Certain prolific authors sometimes use the same version of their text, varying only the information regarding their fields of study (which does not lack interest, specially when it comes to statistical information, but makes the originality of the publication more relative). We have tried to eliminate this bias when the titles were similar and the publications were chronologically close (less than two years apart), and present only a single bibliographic item for these studies [6].



Graph 1. Number of authors that have made two or more publications

The countries relative to the studies

Three-fourths of the studies take into account one or several countries or regions in their spectrum of observation. We have categorized them according to this geopolitical point of view. The remaining fourth (500 texts) is mainly made up of studies, reflections, models and political proposals on the problems of the brain drain and the mobility of students, scientists and highly qualified personnel.

The countries of origin

A total of 971 texts deal with migrations of scientists or highly qualified people with respect to a country or to a region of origin. However, in the migration studied here, being very specific, the countries of origin of the workers mentioned in this migration do not correspond to the traditional

Chart No. 5: Distribution of the studies between host country and country of origin

- *Studies relative to the country of origin and to the host country: 493*
(it is frequently the case of studies on the migrant communities or on the sequences of their migratory experience)
- *Studies relative to the country of origin without any reference to the country(ies) of destination: 478*
(it is frequently the case of socio-political studies on the consequences, for the country of origin, of the emigration of its elite)
- *Studies related to the host country without any reference to the country of origin: 337*
(it is mainly the case of general studies on the consequences of migrations -specialily of students- in the host country and on the social and political matters associated to these migrations)

emigration countries. That is why, for example, the Mediterranean countries (whether European or African) are almost absent from this selection (6 texts) while they are the ones that have produced, in the course of this century, the largest portion of work migrations to northern Europe [7]. Therefore, it appears that, just as it is pointed out by Salt and Findlay (1989), the brain drain phenomenon has been rarely studied in the phenomena of migratory flows "simply because it is considered that it is not an immigration as such and that this phenomenon does not affect a sufficient number of people".

The continents which are the more concerned by the studies on international scientific migrations in respect of beeing the continents of origin are, by order of importance, Asia and Europe (see Table No. 1). In Europe, with the exception of the United Kingdom and Ireland, it does not seem that in the last two years there has been a concern for this problem. But after the fall of the communist regimes in the Soviet Union and in the countries of Eastern Europe, it has been observed that the number of studies regarding these countries has multiplied. Thus, not less that 56 studies were published on Russia in the course of the past five years. Great Britain in the origin of the notion of "Brain Drain" (Royal Society 1963), was the object of 42 studies on the period as a whole. It is evident that this is connected to the fact that British scientists have been directly operational in the United States, a country that represents a real threat for the national scientific community that was afraid of a hemorrhage of its intellectual potential for the benefit of another country. This was also the case, to a lesser extent, of Ireland, which watched as its scientists and studies departed for England.

The total references, which amount to 861 referred to countries of origin and which are noted on Table 1 do not include the 971 studies referenced which refer to a country of origin. This is explained by the fact that certain studies refer to several countries nominally (in which case a single reference may be accounted for several times), or deal with a geopolitical entity: developing countries: 153 references; industrialized countries: 2; countries of the Community: 4; Arab countries: 18; the Caribbean: 10 in which case these references are not accounted for in Table 1.

Table 1. Frequency according to which countries are treated as country of origin*

AFRICA		AMERICA		ASIA		EUROPE	
General	44	General	35	General	50	General	50
South Africa.	1	Argentina	14	Saudi Arabia	1	Germany	9
Algeria	2	Bolivia	1	Bangladesh	2	Austria	2
Cameroon	3	Brazil	9	South Korea	15	Bulgaria	4
Egypt	8	Canada	10	Hong Kong	21	Spain	3
Ghana	3	Chile	5	India	72	Finland	2
Kenya	2	Colombia	14	Indonesia	2	France	9
Libya	1	Costa Rica	3	Iran	14	Georgia	1
Maghreb	3	Cuba	1	Israël	8	Great Britain	42
Morocco	1	Guyana	1	Japan	10	Greece	8
Nigeria	15	Honduras	1	Jordan	1	Hungary	9
Somalia	3	Mexico	4	Lebanon	7	Ireland	10
Sudan	6	Nicaragua	1	Malaysia	3	Italy	2
Swaziland	3	Panama	1	Pakistan	8	Norway	1
Tanzania	4	Paraguay	1	Palestine	1	Poland	12
Zambia	3	Peru	3	Philippines	22	Portugal	1
		Puerto Rico	2	Pop. Rep.of China	87	Czech Republic	4
		Uruguay	3	Singapour	6	Rumania	5
		USA	25	Sri Lanka	5	Russia	56
		Venezuela	6	Turkey	5	Serbia	1
				Taiwan	15	Slovakia	5
				Thailand	4	Slovenia	2
				Vietnam	1	Sweden	3
						Ukraine	4
						Former URSS	10
						Former Czechoslovakia	2
						Former Yugoslavia	2
Total	102	Total	140	Total	360	Total	259

* In this table the reclassification of the countries is based upon a strictly political and not geopolitical distribution.

The host countries

With 426 references (that is 23 % of the group of references), the studies on the United States as beeing an immigration country dominate by far [8] (Table No. 2). United States is also the country that receives more foreign students in the world (more than 400,000 at the beginning of the 1990).

Table 2. Frequency according to which the countries are treated as host countries* [9]

OCEANIA		AMERICA		ASIA		EUROPA	
		Latin America	3	General Asia	3	General	46
						Eastern Europe	1
Australia	25	Canada	44	India	1	Germany	32
		Guyana	1	Israël	6	Spain	2
		USA	426	Japan	7	Finland	1
		Venezuela	1	Pakistan	2	France	31
				Palestine	1	Great Britain	59
				Thailand	1	Italy	2
						Norway	3
						Netherland	3
						Poland	1
						Rumania	1
						Sweden	8
						Switzerland	2
						Former URSS	5
Total	25	Total	475	Total	21	Total	197

* In this table, the classification of the countries is supported on an strictly geographic and not geo-political distribution.

France which arrives in the second place in terms of the number of students received (136.000 [10]) only appears in 31 studies (1.7 %), that is in the fifth position after Great Britain (59), Canada (44) and Germany (32).

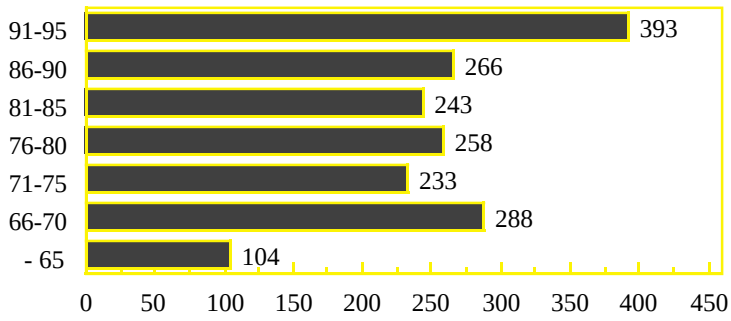
While the most frequently observed countries within the studies of the countries of origin are the southern ones (twice more than the countries of the north, see Table No. 1), the countries of the north represent the main pole of interest for the studies that refer to the host countries. This corresponds to a migratory reality and it is not surprising that the geographic distribution of the studies included in the data base reflects the direction of migration during the period observed: outflow from the south, inflow in the north.

Chronology of indexed studies

In this third part we make a point of following the chronology of the studies indexed by grouping the references for periods of five years in order to minimize the annual variations frequently due to the organization of events, such as international conferences that often generate an important number of works published or unpublished.

Chronology of the set of references

The subject of international migrations of highly qualified people arises at the beginning of the ‘60s [11] and culminates at the end of the same decade. It then exhibits a relative decrease during

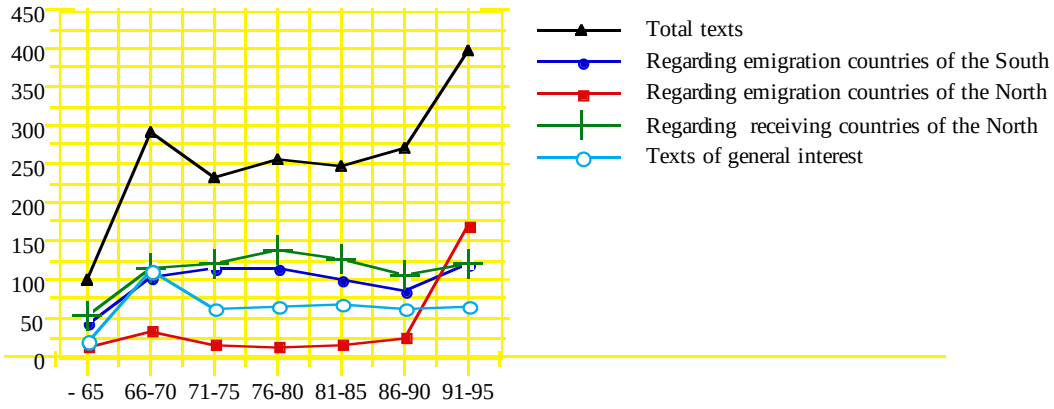


Graph 2. Chronology of indexed studies

the first half of the 70s nonetheless preserving a sustainesd interest until the end of the 80s. It knows a new craze from the end of the '80s, particularly as a result of the phenomena of the return of talents observed in several Asian countries and, even more recently, due to the recent disturbances of the scientific and technical systems of the former Soviet Union and of the countries of Eastern Europe that resulted in new flows of qualified scientists and technicians.

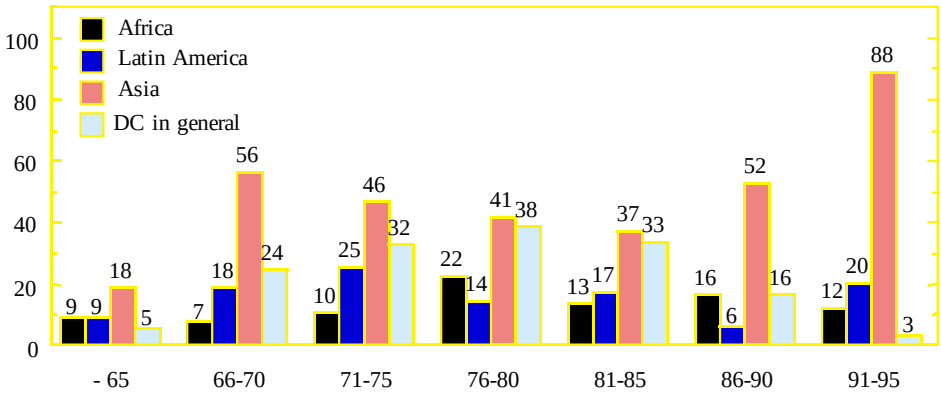
Chronology of references by continents and by countries

This revival in favor for the theme and which is measured quantitatively, mainly since the beginning of the '90s, corresponds also to displacements of interests, whether refering to migration and host countries or continents, or the currents which have moulded the migration fields of highly qualified people for the past four decades (see figures 3, 4, 5, 6 and 7 below).



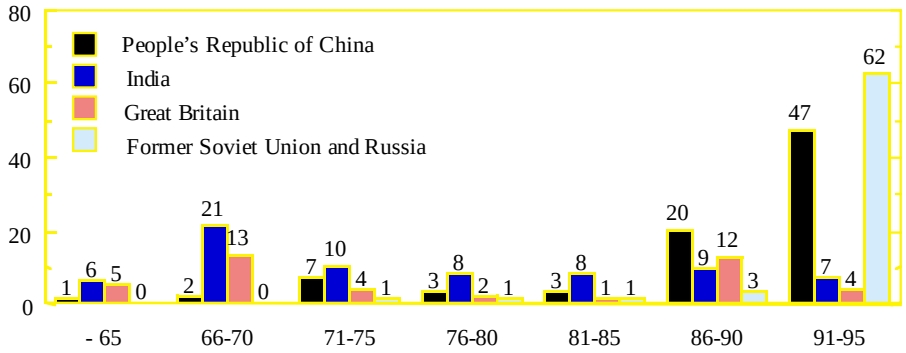
Graph 3. Chronology as a function of geographic zones [12]

In the same manner that figure 3, 4 and 5 show it clearly, the increase in the number of studies during these past five years is explained by the interest granted to the two main poles : the countries of emigration of the north and mainly those of the former Soviet Union and Eastern Europe (where the problem is the loss of educated scientists and the prevention of this loss), and the countries of emigration of the south, specially Asia and more particularly China (where the problem has to do mainly with the return or non-return of students and on the corresponding policies).



Graph 4. Chronologies by continents of the South

In this graph it may be observed that very rapidly two geographic poles dominated the general interest: on the one hand Asia and on the other hand the Developing Countries (DC) perceived as a generic entity. It may be observed that through the years, the interest for the Asian countries has remained (the works on India representing more or less 20% of the whole, exept for the period 66-70 where their representation is of 37 % and the recent period sees a mere 8 % - see graphs 4 and 5). However, if the interest for the studies on Asian countries has remained over the years, the most recent contingent of works is due, as we have mentioned, to the interest granted to the People's Republic of China (see graph below), this has not been the case for the studies about the DC in general, and the interest of the studies about this group extinguished with the impossibility to put into effect different policies that had attempted to remedy the brain drain in the countries of the south. We will return to this subject further on.



Graph 5. Chronology of the texts on China, India, Great Britain and Russia
(Countries of the South and North on which more has been written)

The main thematic currents

In order to determine the main currents that have gone through the field studied and their relative importance in the course of the past forty years, we have proceeded by successive stages to the extent of the enrichment of the data base. Finally, we have kept the currents that we thought were a majority and were significant along the period considered. Six main currents have been defined : "Brain Drain", "Students", "Migration", "Scientific Mobility", "Brain

Gain" and "Reverse Brain Drain or Return" [13]. The work of indexation of the data has spead over than six months ; we considered necessary to stop the respective definitions of these currents in a final manner, once the base was complete and to verify again (and sometimes to correct) record by record, the current in which we had indexed each reference. Only one current was written down by record (except for five studies on brain drain which refer simultaneously to migration in terms of losses and gains for the country of origin and which were reported both in the brain drain and in the brain gain). The definitions of the different currents are given below and the chronology of the different currents is presented in figure No. 6. It is a possible representation of the currents that have gone through the field studied. Other could be substituted. As for every typology of this kind, the most important thing is to define exactly and without ambiguity the categories or currents maintained.

Definitions of the currents presented in the graph

Brain drain : In this category have been classified all the studies that deal with the phenomenon of migration in terms of loss for the country of origin and additionally of gain for the host country (we depart here from the logic of the definition by the UN which conceives Brain Drain "only for the benefit of the industrialized countries with market economy"). In this current are the economic and political studies, sometimes sociological or psychological, which postulate is associated to the migration with the principle of loss for the country of origin.

Students : In this category are classified the general studies on the students either country-wise (whether the host country or the country of origin), either at an international level (flows, tendencies, courses, follow up, etc.), the studies of assessments of programs or on the impact of the policies, the statistics commented, the studies that deal with relations between the country of origin and the students, the role of the students abroad within the framework of the development of the country of origin, of the position of the countries with respect to the sending or welcoming students, as well as the sociological studies that examine specific migrations of students.

Migration : In this category enter the studies in which highly qualified professionals (and not students) are considered as a social group of which the migratory characteristics are studied (particularly or as a whole) such as the migration dynamics and determinants, the different aspects of the migratory experience and the reasons for the return or non-return. These are also historical, demographic, sociological studies that tend to clarify a migration as a whole, for example measurement of flows, satisfaction performance scales, change of attitudes, etc.

Scientific Mobility : These are the scientific migrations in the strict sense of the word and have to do with the university students, the researchers or the high level technicians. These are the historical as well as the specialized studies or articles on the subject, and the studies that deal with the value of the experiences acquired abroad. These studies are registered in the category of scientific mobility when they do not refer to migratory processes as such (described in the preceding category), in which case they are classified in the migration category.

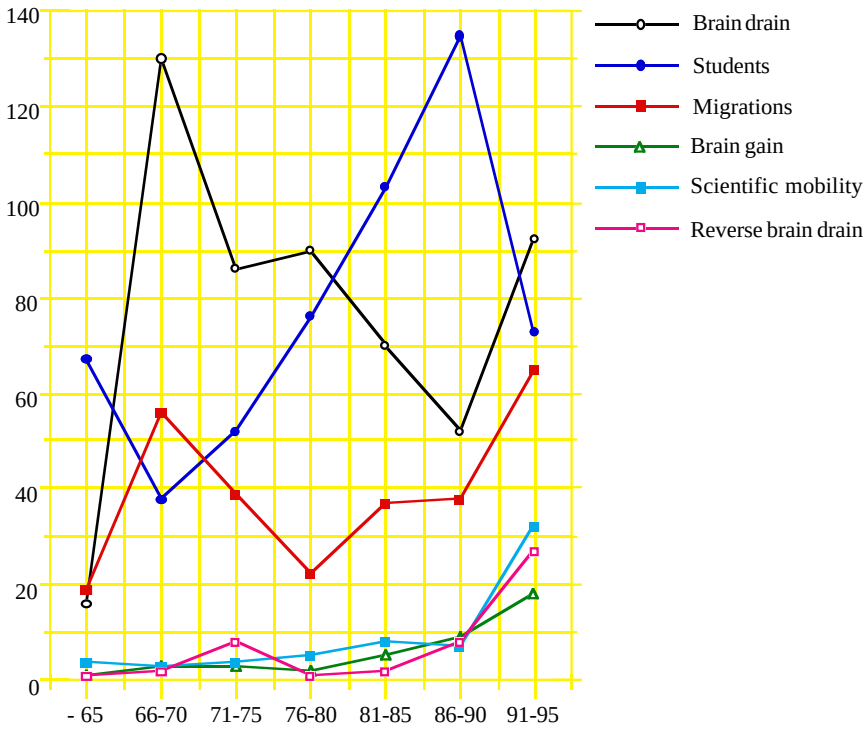
Brain gain : In this category are classified the studies that analyze the role of the intellectual group of expatriates of the country in terms of gains for the country of origin and studies the privileged ties that the expatriate elite permit to establish between the countries of origin and the host countries, as well as the transfer of information and of technology which is thus made possible.

Reverse brain drain or return : In this category enter the studies that refer to the recovery of expatriate competences : the returns effectively made, the impact of these returns on the country of origin as well as the evaluations of the programs with incentives to the return.

The following graph shows the thematic interest of the studies. This graph allows, firstly, to acknowledge that the number of publications of the actual “brain drain” decreases from the beginning of the ‘70s until the end of the ‘80s to forcibly re-emerge during the last five years mentioned on the graph (this latter phenomenon caused, as we have already mentioned, by the interest that has been given to the countries of the former Soviet Union and to the People’s Republic of China). We believe that the decrease experienced from 1970 to 1990 cannot be attributed since the beginning of the ‘70s to the lack of interest for the problem of the brain drain (while a loss for the country of origin), because as confirmed by the other observations, it is precisely during this period that the largest number of studies dealing with the southern countries with respect to the migration of their elite towards the north emerged (see, for example, graph 4, the studies that deal with the DC).

The reason for this outstanding decrease on our graphs results, we believe, from our classification of subjects. In effect, the subject of brain drain characterizes here the general studies or, during the period mentioned, the problem of brain drain was widely articulated around the problem of the students, who represented the most important movement of the migration of elites [14]. This graph shows the decrease of the general studies on brain drain simultaneously with the increase of studies on the students. We believe that this is the case of a compensation that unfortunately we cannot refine in the graph.Finally, a strong progression may be observed in this graph during the last five years, of the three currents that participate in the renewal of the field : return, brain drain, scientific mobility.

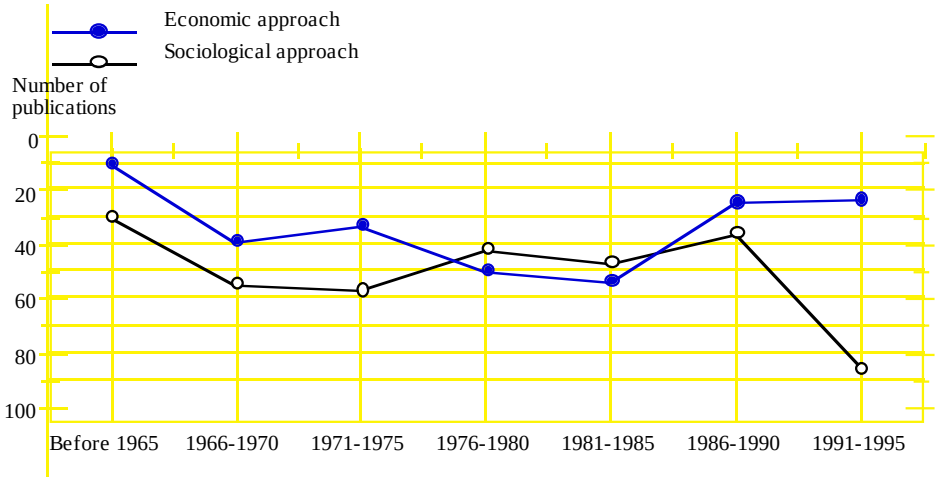
Finally, a strong progression may be observed in this graph during the last five years, of the three currents that participate in the renewal of the field : return, brain drain, scientific mobility.



Graph 6. Chronology of the main currents

The main disciplinary approaches

The studies of an economic nature (or pluri-disciplinary but with an economic focus), which have to do with the evaluation of the cost of the brain drain, as well as with the problems of compensation of countries, are relatively few with respect to the total of the base (194 texts over 1,808, that is, less than 11 % of the total) ; however they have dominated the debate, particularly in the international organisations. The sociological studies are more numerous (310), but beside the studies of the UNITAR (Glaser 70 to 78, among others) they have not marked the debate in such a strong manner as the economic studies (next graph).



Graph 7. Chronology of the economic and sociologic studies

The semantic evolution of "brain drain"

The term of brain drain appeared in 1963 in a document of the Royal Society. It attempts to "dramatize" (Johnson, 1965) the movement of educated personnel (specially scientists and physicians) who departed from the United Kingdom and its low compensations towards the United States, where the demand offered high salaries. The notion of brain drain characterized, therefore, very exactly the phenomenon of loss of educated human capital that occurred in answer to a market signal.

The term was later retaken to denominate the migration of the elite from the countries of the south towards the countries of the north but the concept changes keeping its dimension of economic "drainage" in which, following the pro-third world economic analysis is recorded the continuity of the pillage that is carried out to the detriment of the south (Amuzegar, 1968). Although it is true that the term "drain" keeps its economic connotation, the term "brain" becomes something extremely malleable.

The brain is less and less a complete one and becomes a brain in a process of formation, since it often qualifies the migrant students of the third world (see figure 6). Paradoxically and simultaneously, it represents less and less a "brain" (meaning mostly professionals, intellectuals and scientists), since in this perception, where the economic dominates (it is in effect the notion of drain the predominant one) the term brain becomes a designation of every professional whose qualification may be missed in his country of origin, therefore, according to the studies, the term may also designate indifferently the artisans, the qualified labor or other qualified professionals.

Since then, the term brain drain does not qualify any more a specific migration, that of scientists and intellectuals, but defines a phenomenon that is operated through a migration and which stigmatizes the actual or potential loss suffered by the country of origin, in terms of professional competences (at any level). However, notwithstanding the connotations of the term, the issue of scientists (trained or under training) migrations continues to be critical for the debate.

The ideological controversy: confrontation of economic postulates

However, the opinions today are not unanimous to see this migration as only a source of losses. Some, rejecting the analysis of migrations of professional elites form a paradigm inspired on the neocolonialists analyses, hold the idea that these migrations are beneficial for the country of origin, because of the transfer of funds generated, by the fact that the migrants influence, by their presence, the policy of the host country for the benefit of their country of origin [15], by the participation of the high level expatriates in the development of their country thanks to a transfer of technology (even if they did not return to their country of origin) (Grubel, 1966; Grubel and Scott, 1966b; Johnson, 1967 and 1968). It is the beginning of what has been called "the brain drain controversy" (Das, 1971) where two currents registered within an economic perspective are confronted, the "internationalists" and the "nationalists" (Adams, 1968; Kindleberger, 1977). According to the former, the migration of skills towards the countries of the north constitutes a normal phenomenon in an international market since they go to the countries where their compensation and productivity is optimum (since in this conception migration seems to report as many benefits to the south as to the north [16]). The "nationalists" support their thesis with two assumptions : 1) the international economy does not permit an equitable distribution of competences – going to the north and strongly lacking in the south-, 2) the migratory flows of competence are artificial since they are induced by selective migratory policies of the host countries, in a direct objective of benefit (Amuzegar, 1968).

The "nationalistic" thesis has been retained as a basis for reflection for the preparation of international policies. Thus, the definition of brain drain maintained by the United Nations provides that the phenomenon "can only designate one migratory current directed from the south and to the north – between developing countries and developed countries- and only for the benefit of the industrialized countries with a market economy". The government, as well as international organizations, were encouraged to gather information on the importance of the problem in order to contribute an answer (Grubel, 1976).

In this manner, in 1974 appears the term "Reverse transfer of technology" (UNCTAD, 1974) developed by the UNCTAD which clearly places the debate at the level of international cooperation policies. According to this model of analysis, inspired on the nationalist theories of brain drain, the migration of the elites of the countries of the south "retransmits" in the industrialized countries the benefits of the aid that the north contributes to the south (thus the inversion of the concept of transfer of technology). The objective becomes, then to calculate the losses and find systems to prevent or compensate such losses.

The impossible search for compensation

The first measures, said to be " of prevention ", had as an objective to encourage the "brain" exporting countries in such a way that they could create a political, economic, scientific and social environment adequate for the reduction of the exodus of competences (Baldwin, 1970; Zhalan, 1977). Restrictive measures were then with the purpose of regulating the emigration from the countries of origin in order to stop the exodus and the immigration norms in the host countries so as to eliminate the measures that encouraged the introduction into the country of the north of the elites coming from the south (Böhning, 1977).

Then the so called restitution measures were proposed which contemplated the return of the educated elites (the host countries should favor the temporary but not final emigration of the intellectual elites) as well as a compensation system that sought to replace by a technical assistance from the north to the south any outflow of specialists from the south. However, the best known of these measures was that of an assessment (Bhagwati and Dellafar, 1973) which provided for the adoption of tax measures intended to the redistribution.

From the origin, these measures were directed to failure since the theoretical approach that served to support these proposals was biased. In fact, it assumed, on the one hand, that all intellectual migrants expatriated themselves for economic reasons, which is not the case (Johnson, 66 and 68 ; Glaser, 78 ; Böhning, 82) and, on the other hand, that there was a "correspondence between the migratory flows and those of capitals, of products, of salaries or of prices" (Salomon, 73). A third bias rests on the difficulty (still active) of measuring the migrations of such elites (contours of the concept of flow, instruments of observation of the non existent movements) since if the exodus from the countries of origin could be recorded, the return could not. Thus, the consequences of the brain drain were seriously overestimated (Johnson, 1966).

These different measures did not have the expected results and il frequently occured that they could not even be applied. The preventive measures, which in principle are the most radical since they have as a purpose to retain the elites in the country offering them attractive incomes and an encouraging professional environment, can barely be considered as transitory measures, but rather as "the" purpose by excellence that is to be achieved. The putting into effect of such policies indeed demands a level of economic, scientific and cultural development beforehand that would create de facto the proper conditions for the resolution of the problem of exodus of competences (Keely, 1986).

The restrictive measures were not successful and were almost non applicable. It would have been required, in fact, in order to achieve the desired objective, that the countries of origin drastically reinforce their emigration regulations. But, on the other hand, that would have resulted in the adoption of a judicial and control system that most of the states could not (and specially would not wish to [17]) put into effect. Also, it would have been required that the host countries would accept to modify their immigration policies, but the latter are not an exclusive prerogative of the States and respond to decisions both geopolitical and economic or social. For this fact, no nation will accept, in the current condition of international relations, to modify its policy of receiving foreigners for the sole suggestion or advice from international organizations.

The restitution measures were not fortunate in their application, since they resulted from the control of individual migrations and therefore required that everytime a specialist from the south settles in the north, that pressure be exercised on him to leave, or that a northern specialist replaces the competence that had been lost in the south. It is not difficult to understand that this type of considerations does not serve to prepare cooperation policies from the north to the south and that other geopolitical parameters are the ones that prevail. These measures were, therefore, also a fiasco.

The compensatory measures, mainly the idea of taxation (Bhagwati) were based on the creation of a fund serving to the development of the countries of origin. The idea was to reimburse, for every immigrant educated, the cost of his education. However, these measures were difficult to adopt, both conceptually and at the level of the statistical instruments that it was necessary to implement (Mundende, 1989). The option of the taxation faded away, at the same time that the concept of "reverse transfer of technology" (UNCTAD 1987b), but it has generated numerous debates and originated numerous studies between 1973, the time when the idea arouse, and 1987, moment when it was finally abandoned.

The sociological career of the brain drain

Together with the debate on the remedies which are necessary to bring to the brain drain (based exclusively on a macro-economic approach of the phenomenon), another organ of the United Nations (United Nations Institute for Training and Research – UNITAR), started to examine the phenomenon of the brain drain with the help of sociological tools (the first publication of UNITAR's project on the brain drain was published in 1970). This aspect, which departed fundamentally from the economic perspectives that gave rise to the "controversy" and to the attempts of "remedies", was not new, however, to analyze the migratory phenomena [18], and a good number of references prior to this date had used sociological approaches to discuss subjects, frequently limited indeed, of the problems of brain drain (see figure 7).

However, these studies brought a new perspective of the phenomenon. When published in 1978, the results of this huge work (Glaser and Habers, 1978), unique in its kind for the number of people surveyed (6,500 students) and the number of countries implied (11), revealed some unexpected aspects of the brain drain (which should make reference for the years -and even the decades- to come) showing for example that, contrarily to the existing postulates: 1) the students that remained in the host country after their studies, planned, however, to return to their country of origin ; 2) that most of those who had already returned, planned to stay there ; and 3) that the ones who stayed abroad were not necessarily those more gifted. Therefore, the migration of students that had been found, among others, in the core of the debate on brain drain, was not necessarily a "drain" since, in the hypothesis that the return were to occur (which the study did not prove) it was then only a temporary migration. In addition, because of its sociological approach, the studies by UNITAR brought forth the huge complexity of the processes and of the migratory dynamics and the infinite variation of the reasons that led individuals or groups of individuals to emigrate and return [19].

It was, then, a matter of questioning the notion of brain drain, such as it served as postulate to the economic analysis of the phenomenon. In addition, thanks to the geopolitical scope of the work, the authors showed that the brain drain was not and could not be a uniform phenomenon since it derived from a social reality which was compulsorily polymorphous since it was connected to the political, social, economic and cultural conditions that prevailed in the different countries. Since then it became evident that the phenomenon was expressed in a different form according to the country and the migration (nature, direction and importance of the flow) and it appeared, therefore, that it was the wrong way to go when claiming as treatment for the brain drain global solutions such as those that up to then had been proposed on the basis of macroeconomic approaches.

However, if the studies of UNITAR's team permitted to understand the complexity of the migratory event, they did not question (although making it relative) the idea of a loss of competences and of talents for the countries of origin. Indeed, if the students and the professionals who planned to return to their country could not manage to do it, the loss became obvious. Thus the return was logically considered as the best remedy against the brain drain and progressively the economic measures globally proclaimed for fighting against this phenomenon yielded to various national approaches that attempted to contribute ad-hoc solutions to answer to exact situations and this mainly in terms of policies favoring the return. Thus, the perception that was held of migrations of elites (students and professionals) was getting closer to the first perception that was held about migrations, namely that they were going to favor the development of the south [20]. In this manner the studies by UNITAR leaving hope for the return of those (trained or under training) who had emigrated, reinscribed the migration of the elites in a process of transfer of technology and of competences.

The inflexion of the strictly economic research (which is observed very neatly in graph 7) did not imply the termination of this type of approach. However, this no longer has the resonance chamber that was offered by international organisations. In addition, it clearly appeared that if

the concept of brain drain, while the phenomenon of losses of human resources for the country of origin came out from the economist conceptions of the third world of the decades of the ‘70s and ‘80s, retakes its course from the beginning of the ‘90s for a new run where it retakes its primary definition, that is, which qualifies again a migration of scientific personnel, researchers and high level technicians already educated and who leave to foreign countries mainly in responde to a political-economic reality.

Indeed, the recent multiplication of the studies on the brain drain (which are of a mainly psychological nature, see figure 6) corresponds to the increasing interest given to the problem of scientific migrations of the countries from Eastern Europe and the subject of the return (among these, we should note the large number of studies that have to do with Chinese students, see figure 5). All the studies that have to do with the scientific mobility and the brain gain are also recorded in the strong increase of sociological studies (figure 6). However, the noticeable element is that the very term of brain drain is rarely questioned and just by looking at recent studies (the studies by Rose are a good illustration) it is possible to understand that the migration of highly qualified people is always considered as a loss for the country of origin.

Towards new perspectives: together with the brain return, the diaspora option

The recent period has been marked by two approaches that have contributed to opening new perspectives : the return of brains (which we have already discussed) and the diaspora option (Meyer, Charum, 1995) [21]. In effect, the decade of the 1980s saw the development in parallel to the study of the losses caused by the exodus, the symmetrical concept of “return of brains” or of “return of competences” [22]. The “small dragons” of Southeast Asia are the champions of the return [23]. The policies adopted since the ‘60s and the ‘70s have as their purpose the systematic reintegration of their nationals educated abroad [24]. Among the latter probably are South Korea and Taiwan the ones that adopted the most decisive repatriation policies (Chang, 1992 ; Yoon, 1992 ; Song, 1991).

The efficiency of these policies has remained very limited during the ‘60s and the ‘70s. In order to take the example of Korea, it is only as of the ‘80s that it has been possible to observe important rates of return of expatriate researchers and engineers from the United States (Song, 1991). The case of Korea, as that of other countries recently industrialized of the region, shows very well the fact that the return of the scientific and technical elites is largely connected to the economic development of the country, accompanied by the development of a successful national research system [25], and which is extremely dependent on the density and the quality of exchanges existing between the countries of origin and the group of expatriate intellectuals [26].

The diaspora option consists in connecting the national researchers who live abroad with the national scientific community around scientific activities of common interest. However, this does not represent a totally new policy. What is new is the systematic web that was made possible by the development of modern communications techniques, which permits a demultiplied and more intensive configuration, which must carry a number or relations and of exchanges between the members of the group of expatriates, a lot more numerous. An increasing number of initiatives was taken in the course of the last few years on the part of several countries in order to report, mobilize, organize and reconnect their expatriate researchers with the scientific community present in the national territory. It is specially the case of Chile, Colombia, South Korea, Ethiopia, India, Israel, Rumania, Singapore, Taiwan and Venezuela (Gaillard, Meyer, 1996). Among these different countries, probably Colombia offers, with its “Caldas network”, one of the most advanced examples of an attempt for reconnection of expatriate researchers (Charum, Granes and Meyer, 1996).

However, if the idea seems simple and seducing, the putting into effect is much more complex (Meyer, Gaillard, Schlemmer, 1995) [27]. First, it reveals an internal contradiction since the model lies on a double postulate: on the one hand, that of the universality of science and on the other, on which there is in expatriate researchers a feeling of national belonging. The observation shows that the more the researchers consider themselves scientists, the more they tend to use the network of the group of expatriates as an international scientific network, privileging the exchange with their peers and not giving great interest to their colleagues outside their field, even if these are nationals, since science has no frontiers... Inversely, the more they feel they belong to the nation, they yield more to the temptation to transform the network of the group of expatriates into a network of exchange and mutual aid, diluting their strictly scientific and technical potential (Schlemmer et al., in this volume)

However, the diaspora option continues to be, with the return, one of the most promising solutions to fight against the negative effects of brain drain, taking advantage of same. Retrospectively, it is interesting to note that this approach has ties with a recurrent subject of the past, such as the development of the country of origin through their expatriate elites. It was the dominant principle of the concept of “transfer of technology” tied to the study abroad, it was one of the dearest subject for “internationalists” of the ‘70s. It appears that there is currently a consensus around this idea, and it is interresting to notice that the people who during a long time enrolled in the nationalistic current now recognize the opportunity represented, for the countries of origin, by the migrations of their elites abroad. Bhagwati who, in the years 73-75 was a recognized specialist of the studies of the taxation and compensation systems wrote in 1994: “These countries (the DC) modified their conception... they increasingly see in this migration of more gifted nationals an opportunity for them to distinguish themselves and contribute to the glory of their country of origin... These countries expect to use to their own advantage the talents of their nationals abroad. In brief, the scheme underway today is not of brain drain but rather of the group of expatriates” (Bhagwati, Rao, 1994).

However, this option goes even farther. It becomes a political choice increasingly systematic. It is a tentative of the part of the countries of origin to accede to the multiple competences (professionals but also of relations) of their expatriate elites. It is therefore, in a context of globalization of science and of communication media, to try to valuate and re-inject at a national level the benefits that derive from the studies by expatriate scientists, the latter becoming the front places and the means for extension of a national science.

However, it is an option that cannot live by itself and, if it is indispensable for the success of the policies of return, it also has the need of the flows of return in order to activate and renew itself. In effect, the more professional elites enroll in an active network of expatriates and participate in associations that will permit them to connect and maintain contact with their professional community of the country of origin, the easier will be the decision to return the day they have the opportunity to do it (Song, 1997). On the other hand, the more professionals that return to the country, the greater the interface between local professional communities and the group of expatriates abroad. Finally, these increasingly larger returns will permit to reduce the existing gaps between the fields of scientific and technical activity at a national level and those in which the expatriates are operational. In this manner those returns will participate in the reinforcement and in the diversification of the national scientific communities, reinforcement and diversification that are indispensable to maintain and develop the diaspora option itself.

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[1] It is the case specially of the “Bibliography on skilled migration” published in Etudes Migrations (Todisco, 1993).

[2] The purpose here is not to try to question the interest or basis of such studies but simply their relevance within our context

[3] The databases managed by the Institute of Scientific and Technical Information (INIST) in France, even if they permit a privileged access to the French and European scientific literature, also have a linguistic coverage where the English language widely dominates : 75 % of the references indexed in PASCAL are in English and 10 % only in French.

[4] Frequently, in relation to the information regarding the observance of scientific communities within which the authors live and work. To this respect it does not refer particularly to scientific studies on the subject, but rather of observations or testimonies that are the majority of the time expressions of concerns.

[5] Most of the article published in these high impact scientific disclosure magazines are frequently signed by scientists of “hard” sciences. These scientific magazines are not accounted for in the number of scientific journals examined in this section.

[6] News in which the information is given to the various supports of the publication : “also published in... on..., etc.”

[7] For comparison purposes see “Migration return : A Bibliographical Overview” by Anne Marie Gaillard (1994) where the author shows that the studies on the returns of migrations deal mostly with migrations to Europe and mainly those that come from the Mediterranean.

[8] However, we are far from achieving, on the current base, the percentage of more than 70 % in the bibliography of Altbach and Lulat (1985) performed in the United States on university migration. This latter bibliography took into account a considerable number of university studies which, as refers to us, we have not taken into account as a function of the selection criteria that we stated above.

[9] Two studies referenced treat Africa as a host country, one general text and a text on Nigeria.

[10] UNESCO, Statistical Results, 1993.

[11] Of the 104 references published prior to 1965, 27 were published before 1960.

[12] The fact that the total of the curves does not correspond to the curve of the total of the texts is explained by the fact that certain texts deal as the same time with the migration country and the immigration country.

[13] For example, we have defined other currents such as Brain Overflow, Brain Drain for host countries, policies and programs, etc., which we definitely abandoned in the final analysis.

[14] As of 1970 we have witnessed a considerable number of flows of students abroad. This growth was of 95 % during the decade of 1970 and of 29 % in the decade of 1980 (percentages calculated according to the figures of the UNESCO published in 1993 which indicate the grow of the flows of the decade with respect to the previous decade).

[15] As a precedent to the foregoing, the increasingly widespread idea now on the political role of the expatriates in the host country (Bhagwati and Rado, 1994).

16 In this context, M.S. Das in 1971 talks about substituting the term “brain drain” by the term “brain gain” or “brain exchange”.

[17] The States that had made the political choice of a drastic migration regulation in regards to their elites (Eastern countries, for example) were not models of democracy and had not required the recommendations from international experts to put those measures into effect.

[18] The sociologists from the Department of Urban Ecology of the School of Chicago, had fully experienced the sociological methods (among others) for the analysis of migrations from the beginning of the century (1914-1930).

[19] The studies by UNITAR inspired equally numerous studies performed during the following decade, both as refers to the phenomenon of the exodus and as refers to the return

[20] After the independence, the idea that the formation of elites in the countries of the north was going to favor the development of the south was largely prevailing and was maintained extensively in the country of the south (Maliyamkono, 1980), and this, notwithstanding the development of the "nationalist" model according to which the migration of elites of the south was equivalent to an economic pillage of their countries.

[21] Meyer J-B., Charum J., 1995, La fuite des cerveaux est elle épuisée ? Paradigme perdu et nouvelles perspectives, *Cahiers des Sciences Humaines*, 31(4), 1004-17 : 1015 (note des éditeurs scientifiques).

[22] Two international organizations have been financing equally for the past twenty years the projects of assistance for the return of qualified immigrants to their countries of origin with uneven successes : the Inter-Governmental Committee for Migrations (ICM) and the TOKTEN program (Transfer of Knowledge Through Expatriate Nationals), administered by the UNDP.

[23] Meyer, Charum, *op. cit.,* p 1009 (note des éditeurs scientifiques).

[24] Recent studies performed on brain drain in Taiwan and in South Korea show, however, that the brain drain, specially towards the United States, is above all a migration of students and not an exodus of qualified researchers and engineers (Chang, 1992).

[25] By eliminating the aids for the return of its expatriate scientists and engineers since the beginning of the '90s, Korea recognized the fact that such aids did not played a predominant role in the decision of the return. They were, among others, replaced in 1994 by a program called "brain pool" which permits the Korean science and technology institutions to invite for stays limited in general to one year, researchers and engineers living abroad (Song, 90).

[26] Simultaneously with the putting into effect of the "brain pool" the Korean government strengthened its support to the associations of Korean scientists and engineers abroad, which established and feed data bases that served as interface between national demand in experience and technology and the Korean researchers living abroad (idem).

[27] Meyer J-B., Gaillard J., Schlemmer B., 1995, Nouvelle approche des migrations scientifiques internationales, Chroniques du Sud (Orstom), No 15, 59-72, p 64 (note des éditeurs scientifiques).

Les migrations internationales de personnes hautement qualifiées : un itinéraire bibliographique et conceptuel*

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Introduction : constitution de la base

Nous présentons dans cette introduction les critères adoptés pour sélectionner les références ainsi que les différentes sources et méthodes utilisées pour constituer notre base bibliographique.

Critères de sélection

Les critères de sélection que nous avons retenus visent à répertorier les travaux concernant les migrations d'intellectuels, de scientifiques et de techniciens de haut niveau. Toutefois ne voulant pas exclure de notre base les travaux généraux et théoriques sur la problématique du brain drain et l'exode des cerveaux, notre première sélection s'est opérée sur les mots clés : *brain drain*, exode des cerveaux, fuite des cerveaux, *reverse transfer of technology* en acceptant le fait que ces concepts, bien qu'intégrant toujours les migrations intellectuelles, scientifiques et techniques aient évolué et se soient élargi, durant une période que l'on peut situer de 74 à 87, à toutes les professions qualifiées migrantes en provenance des pays du Sud. De cette première sélection ressortent à peine 300 titres (298).

Le reste des références a été sélectionné sur la base des catégories professionnelles. En cela nous nous démarquons de bon nombre de travaux antérieurs (notamment bibliographiques) qui, étudiant le *brain drain* et les migrations qualifiées (ou des talents) font entrer dans la catégorie des « cerveaux » les personnels dont les qualifications font défaut au pays d'émigration et profitent au pays d'immigration. C'est ainsi que certains travaux retiennent jusqu'aux ouvriers qualifiés ou certaines catégories d'employés, considérés comme main-d'oeuvre qualifiée (ce qu'elle est) dont la perte cause un préjudice important pour le pays d'origine [1] ; ils ne font pas partie de cette base.

Identifier les migrations de personnel hautement qualifié à partir des catégories professionnelles, relevait de la gageure, dans le contexte d'une étude internationale. En effet, les professions et catégories sociales, lorsqu'elles sont clairement délimitées (ce qui n'est pas toujours le cas dans les études rencontrées) ne sont pas homogènes et donc pas comparables car ne partant pas de la même histoire du travail, ne correspondant pas au même système de protection sociale (ce qui a façonné dans certains pays occidentaux les appartenances catégorielles), ne relevant pas non plus de la même analyse statistique. C'est ainsi que certains concepts et mots

* Ce texte a bénéficié des apports des membres de l'équipe du projet « Le *brain drain* revisité à travers le cas de la Colombie : étude du réseau Caldas » conduit par l'IRD (ex-Orstom) et l'Université nationale de Colombie de 1993 à 1996 (note des éditeurs scientifiques).

sont intraduisibles. A titre d'exemple le mot « cadre » n'a pas d'équivalent en anglais ou en allemand, et le mot anglais « professionnal » n'est pas traduisible en français » (Desrosières et Thévenot, 1988). Cela explique en partie le flou des classifications utilisées par les uns ou par les autres et justifie que l'on délimite ici, une catégorie dite « intellectuelle, scientifique et technique », ayant pour caractéristique commune le passage par l'université ou les établissements d'éducation supérieure.

Toutefois voulant cibler ce travail sur la problématique de la migration de haut niveau dans les contextes géopolitiques qui ont été les leurs, nous avons éliminé un grand nombre de travaux qui auraient été éclairants mais dont la problématique centrale n'était pas liée à la migration. C'est ainsi qu'ont été exclus les travaux traitant des communautés scientifiques nationales ou des pratiques et contextes professionnels nationaux (pour les médecins par exemple), même lorsque ces travaux annonçaient des situations propices à la migration ou au brain drain.

N'ont pas été retenus non plus les travaux portant sur les équipements nationaux d'éducation supérieure ou de recherche même lorsqu'ils faisaient état de tentatives d'internationalisation. Il en est de même des programmes nationaux ou internationaux en faveur des échanges académiques (ces derniers étant le plus souvent descriptifs). En contrepartie ont été retenues les études examinant les migrations ou les échanges qui ont pu avoir lieu dans le cadre de ces équipements et de ces programmes ainsi que les rapports d'évaluation dont nous avons eu connaissance.

Nous avons également éliminé un très grand nombre de travaux dans le halo de la migration des étudiants : ceux qui traitent de la réussite académique, des questions d'équivalences, des questions linguistiques, les guides pratiques, les descriptifs de cursus, de programmes et de collaborations inter-universités, de même que les travaux qui portent sur le recrutement, les admissions, les équipements académiques et sociaux spécifiques à l'environnement de ces étudiants (services de conseil entre autres). Nous n'avons pas non plus retenu les travaux qui traitent de la « nébuleuse question des besoins des étudiants étrangers » (Altbach et Lulat, 1985 : 32) : problèmes de logement, de finances, de santé, de loisirs etc., qui n'étaient pas non plus centraux à notre problématique de migration.

De même n'ont pas été retenus les travaux qui ne traitent de ces migrations que sur le plan légal (ce qui n'implique pas que cet aspect ne soit pas abordé dans bon nombre de travaux sélectionnés). Les études psychologiques et anthropologiques ont également été passées au crible, et n'ont pas été retenues les études portant sur de petites communautés qui examinent les évolutions d'une identité (propre, ethnique ou culturelle) ou les aléas individuels ou collectifs liés aux situations de migration (maladie mentale chez les étudiants de telle nationalité sur tel campus, habitudes alimentaires de tel autre groupe ailleurs, changement de perception du rôle de la femme, ou de l'homme chez tels nationaux asiatiques dans tel état des USA, etc.[2]). Nous avons par contre retenu un certain nombre de travaux sur l'adaptation et l'intégration de communautés et sur des problématiques culturelles lorsque ces études avaient un caractère général ou lorsqu'elles étaient directement en rapport avec les choix de retour au pays d'origine ou de maintien au pays d'accueil.

La collecte des références

La collecte des références documentaires s'est faite d'abord à partir de plusieurs travaux bibliographiques antérieurs sur le thème des migrations scientifiques (Glaser, 78 ; Altbach *et al.*, 85 ; UNCTAD, 87 ; Todisco, 93) et une bibliographie plus générale sur les retours de migration (Gaillard, 94). Elle s'est poursuivie par l'interrogation de bases de données (voir encadré n°1) et la consultation des catalogues des centres de documentations visités (voir encadré n°2). Nous avons ensuite systématiquement vérifié les références bibliographiques des articles et travaux consultés. Cette dernière « récolte » s'est révélée étonnamment féconde mal-

Encadré n°1 : Bases de données interrogées

- CLASE -Citas Latinoamericanas en Ciencias Sociales y Humanidades (Mexique)
- FRANCIS -CNRS (France)
- Dissertation Abstract International (USA)
- Répertoire national des thèses (France)
- LABORDOC base de données du Bureau international du travail (Suisse)
- Magazine Database (USA)
- MEDLINE (USA)
- Social Science Index (USA)
- Sociological Abstracts (USA)

Encadré n°2 : Bibliothèques et centres de documentation consultés

- la bibliothèque du Congrès (Washington D.C., USA)
- la bibliothèque universitaires de Georgetown University (Washington D.C., USA)
- la bibliothèque universitaires de Georges Washington University (Washington D. C,.USA)
- le centre de documentation du Bureau international du travail BIT (Paris, France)
- le centre de documentation de l'Association internationale des universités (Paris, France)
- le centre de documentation du Ciemi(Paris, France)
- le centre de documentation de l'Unesco

gré le systématisme apporté aux consultations préalables des travaux bibliographiques et des bases de données mentionnés. Enfin, nous avons demandé à quelques auteurs parmi les plus prolifiques (y compris les auteurs institutionnels) de compléter les listes de références les concernant.

Au total 1 808 références bibliographiques ont été sélectionnées. Même si nous pensons avoir rassemblé la grande majorité des travaux publiés sur le thème de la migration international des personnes hautement qualifiées, nous ne prétendons pas à l'exhaustivité.

Présentation de la base

Plus des 4/5 des références concernent des travaux publiés sous différentes formes (voir encadré n°3). Parmi ces derniers dominent largement les articles publiés dans des revues scientifiques (672 références). Ils sont suivis par ordre d'importance par les contributions à ouvrages collectifs ou communications à conférences (368 références), par les rapports institutionnels (189 références) et par les ouvrages (129 livres dont 22 actes de colloques et 12 ouvrages collectifs) ; 68 sont articles publiés sur des magazines d'information et 61 articles sur des magazines de vulgarisation scientifique. Parmi les textes non publiés se trouvent principalement les rapports de recherche (dont principalement des thèses qui pour la plupart n'ont jamais été publiées) et des rapports d'institutions nationales, internationales et d'ONG.

Parmi les langues utilisées, l'anglais (avec 1 607 références, soit 88 %) domine largement. C'est une donnée générale de la production scientifique dans le monde. En dépit du fait que nous ayons interrogé plusieurs bases de données ou centre de documentation en France le nombre de travaux rédigés en français ne représentent que 112 références (soit environ 6 %) [3].

Encadré n°3 : Nature des travaux indexés

1 487 textes publiés
- 672 articles de revues scientifiques
- 368 contributions à ouvrages collectifs ou communications à conférences
-189 rapports institutionnels, d'experts, d'ONG ou de sociétés savantes publiés en tant que tels
- 129 livres (dont 22 actes de colloques et 12 ouvrages collectifs)
- 68 articles de magazines d'information
*- 61 articles de vulgarisation scientifique (*Science, Nature,... *etc.)*
321 textes non publiés
- 127 rapports de recherches (dont 103 mémoires et thèses)
- 97 rapports nationaux (dont communications à colloques non publiées)
- 57 rapports d'experts d'organismes internationaux
- 27 rapports d'ONG
-13 autres.

Vient ensuite l'espagnol, et quelques textes en allemand, portugais et italien.

Les 672 articles publiés dans des revues scientifiques sont dispersés dans pas moins de 354 revues dont 265 n'ont publié qu'un seul article. 46 revues ont publié 2 articles, 13 ont publié 3 articles, 6 ont publié 4 articles, 8 ont publié 5 articles et 16 ont publié plus de 5 articles (dont deux numéros spéciaux).

Les champs scientifiques couverts par les revues sont principalement ceux des sciences humaines (anthropologie, démographie, économie, géographie, histoire, psychologie, sciences de l'éducation, sciences de la communication, sciences politiques et sociologie principalement) mais le thème de la mobilité des scientifiques et du personnel académique intéresse aussi, et épisodiquement, les chercheurs des sciences « dures » comme la physique, la biologie et la médecine, dont les articles publiés dans des revues spécialisées abordent principalement le thème de la fuite des cerveaux [4]. Cette préoccupation des chercheurs des sciences « dures » est patente, car si les articles ne représentent qu'une petite proportion des articles de revues scientifiques (47 articles dans 33 revues), il faut y ajouter 54 articles publiés dans des magazines scientifiques (*Science*, *Nature*, *New Scientists* par exemple) [5].

Toutefois ce sont les revues thématiques pluri-disciplinaires qui rassemblent le plus grand nombre de références, en premier lieu celles qui sont spécialisées dans l'étude des migrations, puis celles qui traitent de la science et de l'éducation.

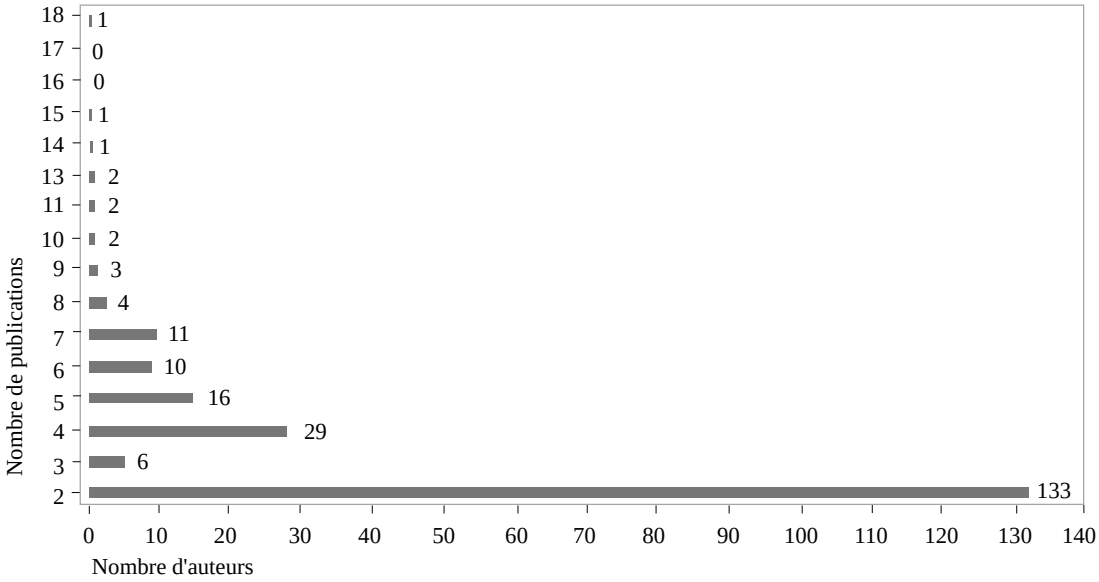
Encadré n°4 : Les « grandes revues » dans le domaine sont :

- International Migration *qui a publié 30 articles durant toute la période avec trois pointes notables de publication : 76-77 (5), 85-86 (7) et 91-92 (7) ;*
- Studi Emigrazione/Etudes Migragions *dont 21 articles ont été publiés depuis 1989, (15 dans un numéro spécial consacré en 1995 à la publication des actes d'un colloque sur les migrations de personnel qualifié) ;*
- Minerva *avec 20 articles publiés pour plus de la moitié avant 1975, avec une légère reprise depuis 1990 (4 articles) ;*
- International Educational and Cultural Exchange, *avec 20 articles publiés entre 1966 et 1978 ;*
- International Migration Review *avec 16 articles principalement publiés durant la première moitié de la décennie 70 et depuis 1990 ;*
- Comparative Education Review *avec 13 articles (dont plus de la moitié -7- furent publiés en 1984)*

Les auteurs, au nombre de 1 597 (dont 150 auteurs institutionnels), sont le plus souvent des personnes qui ont publié seules. En effet, seulement 294 références sont le résultat d'un travail collectif, dont 221 sont signés par deux auteurs.

De plus, il s'agit d'auteurs qui pour l'écrasante majorité (84 % soit 1 181 personnes) n'ont publié qu'une seule fois sur le thème. Ce qui tendrait à prouver qu'il n'y a pas pléthore de spécialistes dans le domaine examiné. C'est ainsi par exemple que l'on observe que seulement 13 auteurs de mémoires universitaires (sur les 103 sélectionnés dans la base) ont publié sur le sujet de leur thèse ultérieurement à celle-ci. Par ailleurs, l'écrasante majorité de ces thèses n'ont jamais été publiées et ne sont repérables que dans les bases de données spécialisées.

Toutefois il faut se garder du raisonnement inverse et penser que l'expertise de l'auteur s'accroît systématiquement en même temps que sa liste de publications. S'il existe vraisemblablement et probablement la plupart du temps une concordance entre celle-ci et celle-là, nous ne nous en tiendrons ici qu'à des appréciations quantitatives. En effet, si la fréquence de publications est un indicateur pertinent à relever dans une analyse bibliométrique, il suffit de regarder les titres des travaux de certains auteurs pour comprendre que l'expertise n'est pas uniquement repérable par le nombre de publications et que ces dernières sont parfois la reprise plus ou moins cachée d'un texte initial réaménagé au fil du temps. Certains auteurs prolifiques utilisent parfois la même version de leur texte ne faisant seulement varier que les informations relatives à leurs terrains d'étude (ce qui n'est pas sans intérêt, surtout s'agissant d'informations statistiques, mais relativise l'originalité de la publication). Nous avons tenté d'éliminer ce biais lorsque les titres se recoupaient totalement et que les publications étaient chronologiquement rapprochées (moins de deux ans), en ne présentant qu'une seule notice bibliographique pour ces travaux [6].



Graphique1. Nombre d'auteurs ayant publiés deux publications ou plus de deux publications

Les pays concernés par les travaux

Les trois quarts des travaux référencés prennent en compte un ou plusieurs pays ou régions dans leur spectre d'observation. C'est en fonction de ce point de vue géopolitique que nous les avons catégorisés. Le quart restant (500 textes) est principalement constitué par des études, des réflexions, des modélisations et des propositions politiques sur les problématiques du brain drain et de la mobilité des étudiants, scientifiques et personnels de haute qualification.

Encadré n°5 : Répartition des travaux entre pays d'accueil et pays d'origine

- *Travaux traitant conjointement du pays d'origine et du pays d'accueil : 493*
il s'agit le plus souvent d'études sur les communautés migrantes elles-mêmes ou sur des séquences de leur expérience migratoire.
- *Travaux traitant de pays d'origine sans référence au (aux) pays de destination : 478*
il s'agit souvent d'études socio-politiques sur les conséquences, pour le pays d'origine, de l'émigration de ses élites.
- *Travaux traitant des pays d'accueil sans référence au (aux) pays d'origine : 337*
il s'agit principalement d'études générales sur les conséquences des migrations -surtout d'étudiants- dans les pays d'accueil et sur les questions sociales et politiques associées à ces migrations.

Les pays d'origine

Un total de 971 textes traitent des migrations scientifiques ou hautement qualifiées au regard d'un pays ou d'une région d'origine. Toutefois la migration étudiée ici étant très spécifique, les pays d'origine des travaux répertoriés sur cette migration ne se recoupent pas avec les pays traditionnels d'émigration. C'est ainsi par exemple que les pays méditerranéens (qu'ils soient européens ou africains) sont quasiment absents de la sélection (6 textes), alors que ce sont ceux qui ont produit, au cours de ce siècle, la majeure partie des migrations de travail vers l'Europe du nord [7]. Il apparaît donc, ainsi que le signalent Salt et Findlay (1989) que le phénomène de la fuite des cerveaux a rarement été étudié en association avec les phénomènes de flux migratoires, « tout simplement parce que l'on considère qu'il ne s'agit pas d'immigration à proprement parler et que ce phénomène ne touche pas un nombre suffisant de personnes ».

Tableau 1. Fréquence selon laquelle les pays sont traités en tant que pays d'origine*

AFRIQUE		AMÉRIQUE		ASIE		EUROPE	
General	44	General	35	General	50	General	50
Afrique du Sud.	1	Argentine	14	Arabie Saoudite	1	Allemagne	9
Algérie	2	Bolivie	1	Bangladesh	2	Autriche	2
Cameroun	3	Brésil	9	Corée du Sud	15	Bulgarie	4
Égypte	8	Canada	10	Hong Kong	21	Espagne	3
Ghana	3	Chili	5	Inde	72	Finlande	2
Kenya	2	Colombie	14	Indonésie	2	France	9
Libye	1	Costa Rica	3	Iran	14	Géorgie	1
Maghreb	3	Cuba	1	Israël	8	Grande Bretagne	42
Maroc	1	Guyane	1	Japon	10	Grèce	8
Nigeria	15	Honduras	1	Jordanie	1	Hongrie	9
Somalie	3	Mexique	4	Liban	7	Irlande	10
Soudan	6	Nicaragua	1	Malaisie	3	Italie	2
Swaziland	3	Panama	1	Pakistan	8	Norvège	1
Tanzanie	4	Paraguay	1	Palestine	1	Pologne	12
Zambie	3	Pérou	3	Philippines	22	Portugal	1
		Porto Rico	2	Rép pop. Chine	87	Rép. tchèque	4
		Uruguay	3	Singapour	6	Roumanie	5
		USA	25	Sri Lanka	5	Russie	56
		Venezuela	6	Turquie	5	Serbie	1
				Taiwan	15	Slovaquie	5
				Thaïlande	4	Slovénie	2
				Vietnam	1	Suède	3
						Ukraine	4
						ex URSS	10
						ex Tchécoslovaquie	2
						ex Yougoslavie	2
Total	102	Total	140	Total	360	Total	259

* La classification des pays s'appuie dans ce tableau sur une répartition strictement géographique et non pas géopolitique.

Les continents les plus concernés par les études sur les migrations scientifiques internationales en tant que continent d'origine sont par ordre d'importance l'Asie et l'Europe (voir tableau 1). En Europe, exception faite du Royaume-Uni et de l'Irlande, on ne semble pas, jusqu'à ces dernières années, avoir été réellement préoccupé par la question. Mais suite à la chute des régimes communistes en Union Soviétique et dans les pays de l'Europe de l'Est on a vu le nombre d'études concernant ces pays en tant que pays d'origine se multiplier. Ainsi pas moins de 56 travaux ont été publiés sur l'actuelle Russie au cours des cinq dernières années. La Grande Bretagne à l'origine de la notion de « Brain-Drain » (Royal Society, 1963), a été l'objet de 42 travaux sur l'ensemble de la période. Il est vraisemblable que cela soit lié au fait que les scientifiques britanniques aient été directement opérationnels aux États-Unis, pays représentant une réelle menace pour la communauté scientifique nationale qui craignait de voir une hémorragie de son potentiel intellectuel au profit d'un autre pays. Cela a également été, dans une moindre mesure, le cas de l'Irlande voyant ses étudiants et ses scientifiques partir pour l'Angleterre.

Le total des références, au nombre de 861 traitant des pays de départ portées dans le tableau 1 ne recouvrent pas les 971 travaux référencés traitant d'un pays de départ. Cela s'explique par le fait que certains travaux traitent de plusieurs pays nominativement (auquel cas une même référence peut être comptabilisée plusieurs fois), ou traitent d'une entité géopolitique : pays en développement : 153 références, pays industrialisés : 2 ; pays du Commonwealth : 4 ; Pays arabes : 18 ; Caraïbes : 10 (auquel cas aucune de ces références n'est comptabilisée dans ce tableau 1).

Les pays d'accueil

Avec 426 références (soit 23 % de l'ensemble des références), ce sont les travaux sur les États-Unis en tant que pays d'immigration qui dominent largement [8] (cf. tableau 2). Les États-Unis est également le pays qui accueille le plus d'étudiants étrangers dans le monde (plus de 400 000 au début des années 1990).

Tableau 2. Fréquence selon laquelle les pays sont traités en tant que pays d'accueil* [9]

OCÉANIE		AMÉRIQUE		ASIE		EUROPE	
		Amérique Latine	3	Général Asie	3	Général	46
						Europe de l'Est	1
Australie.	25	Canada	44	Indie	1	Allemagne	32
		Guyane	1	Israël	6	Espagne	2
		USA	426	Japon	7	Finlande	1
		Venezuela	1	Pakistan	2	France	31
				Palestine	1	Grande Bretagne	59
				Thaïlande	1	Italie	2
						Norvège	3
						Pays-Bas	3
						Pologne	1
						Roumanie	1
						Suède	8
						Suisse	2
						Ex-URSS	5
Total	25	Total	475	Total	21	Total	197

* La classification des pays s'appuie dans ce tableau sur une répartition strictement géographique et non pas géopolitique.

La France qui arrive en deuxième position en termes de nombre d'étudiants étrangers accueillis (136 000 [10]) n'apparaît que dans 31 travaux (1,7 %), c'est-à-dire au en cinquième position après la Grande Bretagne (59), le Canada (44) et l'Allemagne (32).

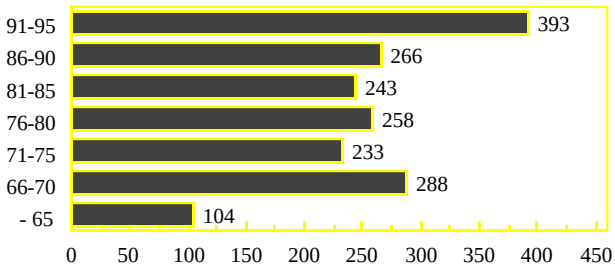
Alors que les pays du sud sont ceux qui sont le plus souvent observés dans le cadre des études qui regardent les pays d'origine (deux fois plus que les pays du nord cf. tableau n°1), les pays

du nord constituent le principal pôle d'intérêt pour les études qui regardent les pays d'accueil. Cela correspond à une réalité migratoire, et il n'est pas étonnant que le dispaching géographique des travaux de la base reflète le sens de la migration durant la période observée : départ du sud, accueil au nord.

Chronologie des travaux indexés

Dans cette troisième partie nous nous sommes attachés à suivre la chronologie des travaux indexés en regroupant les références par périodes de cinq années pour atténuer les variations annuelles souvent dues à l'organisation d'événements tels que conférences internationales qui génèrent souvent des nombres importants de travaux publiés ou non publiés.

Chronologie de l'ensemble des références

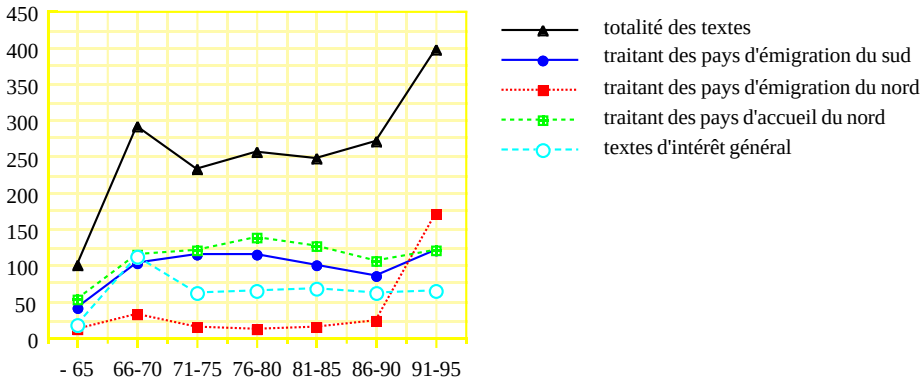


Graphique 2. Chronologie des travaux indexés

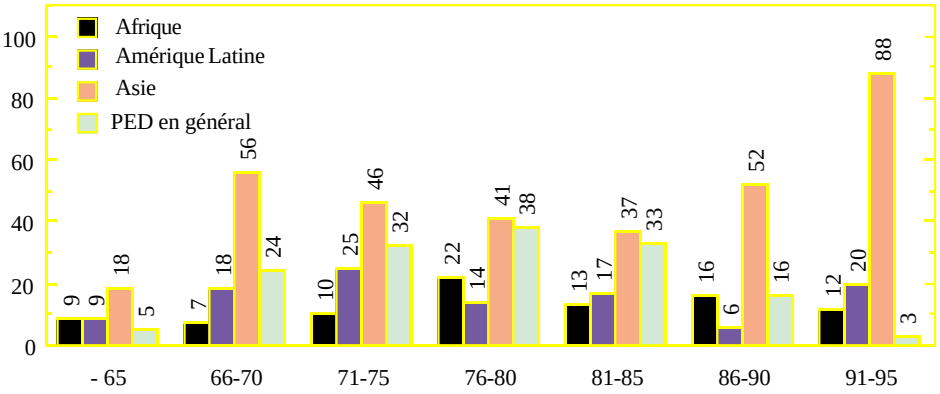
Le thème des migrations internationales des personnes hautement qualifiées émerge au début des années 60 [11] pour culminer à la fin de la même décennie. Il connaît ensuite un déclin très relatif au cours de la première moitié des années 70, tout en conservant un intérêt soutenu et jusqu'à la fin des années 80. Il retrouve un engouement renouvelé à partir de la fin des années 80 suite notamment aux phénomènes de retour de cerveaux observés dans nombre de pays asiatiques et, plus récemment encore, aux bouleversements récents des systèmes scientifiques et techniques de l'ex Union Soviétique et des pays d'Europe de l'Est qui ont engendrés de nouveaux flux de personnels scientifiques et techniques qualifiés.

Chronologie des références par continents et par pays

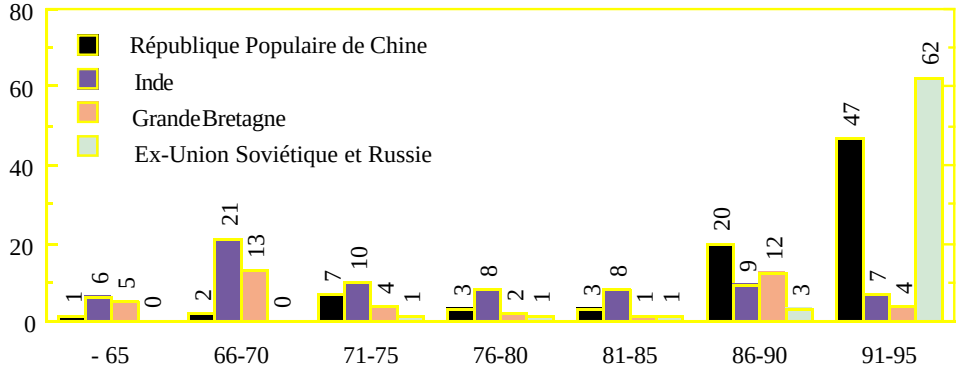
Ce regain de faveur pour le thème qui se mesure quantitativement, principalement depuis le début des années 90, correspond également à des déplacements d'intérêt, tant en ce qui concerne les pays ou les continents d'émigration et d'accueil étudiés que les courants qui ont façonné le champ des migrations des personnes hautement qualifiées au cours des quatre dernières décennies (cf. figures 3, 4, 5, 6 et 7).
Ainsi que les figures 3, 4 et 5 le montrent clairement, l'augmentation du nombre de travaux au cours des cinq dernières années s'explique par l'intérêt porté sur deux pôles principaux : les pays d'émigration du nord et principalement ceux de l'ex-Union soviétique et de l'Europe de l'Est (où la problématique est celle de la déperdition en scientifiques formés et de la prévention contre



Graphique 3. Chronologie en fonction des zones géographiques [12]



Graphique 4. Chronologies par continents du Sud



Graphique 5. Chronologie des textes sur la Chine, l'Inde, la Grande Bretagne et la Russie (Pays du Sud et du Nord sur lesquels on a le plus écrit)

cette déperdition), et les pays d'émigration du sud, notamment l'Asie et plus particulièrement la Chine (où la problématique porte principalement sur le retour ou non-retour des étudiants et sur les politiques afférentes).

Il apparaît dans ce graphique que très vite deux pôles géographiques ont dominé l'intérêt général : d'une part l'Asie et d'autre part les pays en développement (PED) perçus comme une entité générique. On peut constater qu'au fil des ans, l'intérêt s'est maintenu concernant les pays asiatiques (les travaux sur l'Inde représentant plus ou moins 20 % de l'ensemble, sauf pour la période 66-70 où ils en représentent 37 % et pour la période récente où ils représentent à peine 8 %, voir graphiques 4 et 5). Toutefois si les travaux sur les pays asiatiques ont gardé

de leur intérêt au fil des ans, le contingent le plus récent des travaux étant dus, nous l'avons déjà mentionné à l'intérêt porté à la République populaire de Chine (voir graphique suivant), il n'en est pas de même des travaux traitant des PED en général, et l'intérêt des travaux pour cette entité s'est épuisée avec l'impossibilité de mise en oeuvre des différentes politiques que l'on avait tenté d'élaborer pour remédier à la fuite des cerveaux des pays du Sud. Nous y reviendrons ultérieurement.

Les principaux courants thématiques

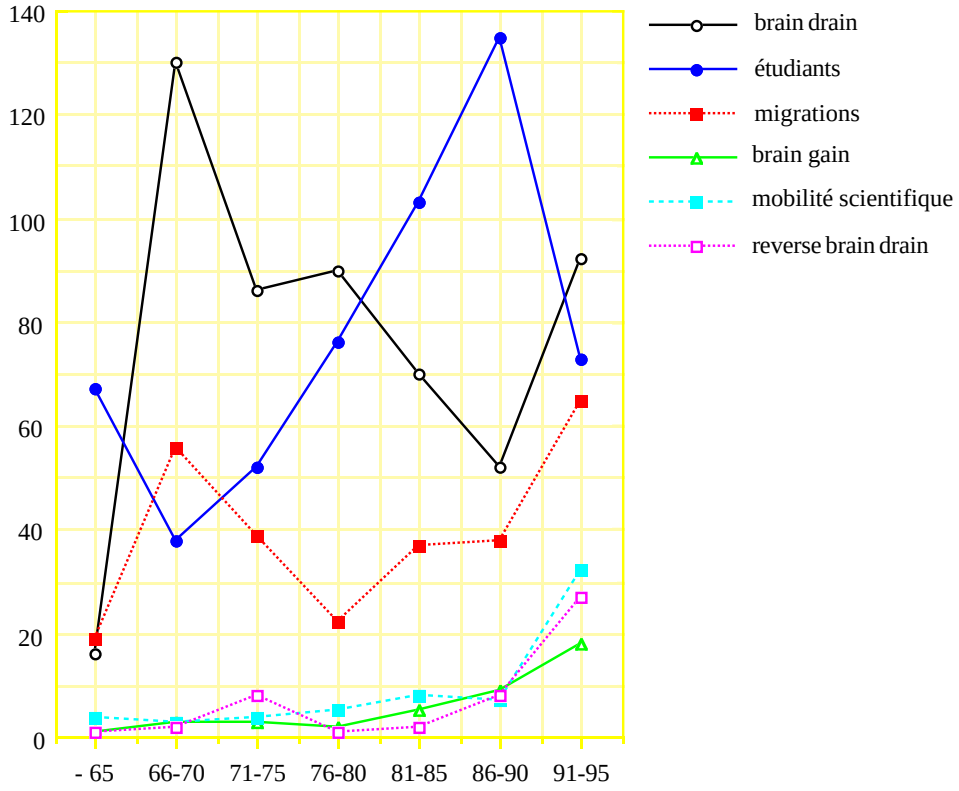
Pour déterminer les principaux courants qui ont traversé le champ étudié et leur importance relative au cours des quarante dernières années, nous avons procédé par étapes successives au fur et à mesure de l'enrichissement de la base. Nous n'avons finalement retenu que les courants qui nous apparaissaient comme majoritaires et significatifs tout au long de la période considérée. Six courants principaux ont été définis : « Brain drain », « Étudiants », « Migration », « Mobilité scientifique », « Brain gain » et « Reverse Brain drain ou retour » [13]. Le travail d'indexation des données s'étant échelonné sur plus de six mois nous avons considéré nécessaire d'arrêter les définitions respectives de ces courants de façon définitive une fois la base complète et de revérifier (et parfois corriger) fiche par fiche le courant dans lequel nous avions indexé chaque référence. Un seul courant a été noté par fiche (sauf pour 5 travaux sur le brain gain qui traitent concomitamment de la migration en termes de pertes et de gains pour le pays d'origine et qui sont répertoriés à la fois dans le brain drain et dans le brain gain). Les définitions des différents courants sont données ci-après et la chronologie des différents courants est présentée dans la figure 6. C'est une représentation possible des courants qui ont traversés le champ étudié. D'autres pourraient s'y substituer. Comme pour toute typologie de ce genre, le plus important est de définir précisément et sans ambiguïté les catégories ou courants retenus.

Définition des courants présentés dans le graphique

Brain drain : Sont classés dans cette catégorie tous les travaux qui abordent le phénomène de la migration en termes de déperdition pour le pays d'origine et accessoirement de gain pour le pays d'accueil (nous divergeons ici de la logique de la définition de l'ONU qui conçoit le Brain Drain uniquement « au profit des seuls pays industrialisés à économie de marché »). Se retrouvent dans ce courant des travaux économiques et politiques, parfois sociologiques ou psychologiques dont le postulat associe la migration avec le principe de perte pour le pays d'origine.

Étudiants : Sont classés dans cette catégorie les études générales sur les étudiants soit au niveau d'un pays (qu'il soit d'accueil ou d'origine), soit au niveau international, (flux, tendances, cursus suivis, etc.), les travaux d'évaluations de programmes ou sur l'impact des politiques, les statistiques commentées, les travaux qui traitent des relations entre pays d'origine et étudiants, du rôle des études à l'étranger dans le cadre du développement du pays d'origine, de la position des pays concernant l'envoi ou l'accueil d'étudiants, ainsi que les travaux sociologiques qui examinent des migrations spécifiques d'étudiants.

Migration : entrent dans cette catégorie les travaux où les professionnels (et non les étudiants) hautement qualifiés sont considérés comme un groupe social dont on étudie les caractéristiques migratoires (partiellement ou dans leur ensemble) tels les dynamiques et déterminants de migration, les différents aspects de l'expérience migratoire et les raisons du retour ou du non-retour. Il s'agit également de travaux historiques, démographiques, sociologiques qui



Graphique 6. Chronologie des principaux courants

visent à éclairer une migration dans son ensemble, par exemple mesure des flux, réalisation d'échelles de satisfaction, changement des attitudes etc.

Mobilité scientifique : Il s'agit des migrations scientifiques au sens strict du terme et elles touchent des universitaires, des chercheurs ou des techniciens de haut niveau. Ce sont les travaux historiques sur le sujet, les ouvrages ou articles spécialisés sur le thème, les travaux qui traitent de la valeur des expériences acquises à l'étranger. Ces travaux sont inscrit dans la catégorie mobilité scientifique lorsqu'ils ne traitent pas des processus migratoires en tant que tels (décrits dans la catégorie précédente) auquel cas ils sont classés dans la catégorie migration.

Brain gain : Sont classés dans cette catégorie les travaux qui analysent le rôle de la diaspora intellectuelle du pays en termes de gains pour le pays d'origine et étudie des liens privilégiés que les élites expatriées permettent d'établir entre les pays d'origine et les pays d'accueil ainsi que le transfert d'information et de technologie rendu ainsi possible.

Reverse Brain drain ou retour : Entrent dans cette catégorie les travaux qui étudient la récupération des compétences expatriées : les retours effectivement effectués, l'impact de ces retours sur le pays d'origine ainsi que les évaluations des programmes incitatifs au retour.

Le graphique suivant montre l'intérêt thématique des travaux référencés. Ce graphique permet d'abord de constater que le nombre de publications du courant « brain drain » diminue dès le début des années 70 jusqu'à la fin des années 80 pour resurgir avec force au cours des cinq dernières années du graphique (ce dernier phénomène étant dû, nous l'avons déjà mentionné, à l'intérêt porté aux pays de l'ex-Union soviétique et à la République populaire de Chine). Nous pensons que la baisse constatée entre 1970 et 1990 n'est pas à imputer dès le début des années 70 au manque d'intérêt pour le problème du brain drain (en tant que déperdition pour le pays d'origine), car les autres observations le confirment, c'est justement pendant cette

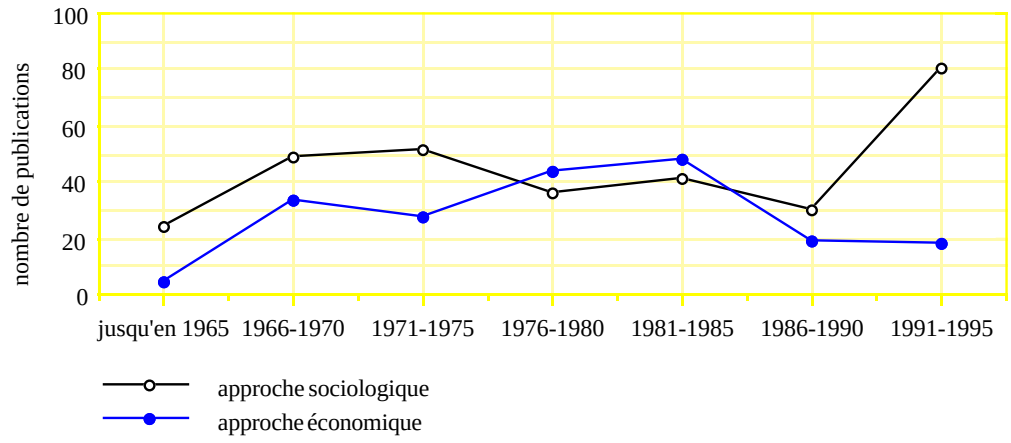
période qu'ont fleuri le plus grand nombre de travaux traitant de la perte subie par les pays du Sud en raison de la migration de leurs élites vers le Nord (voir par exemple graphique 4, les travaux traitant des PED).

La raison de cette diminution notable sur notre graphique provient, croyons-nous, de notre classification des thèmes. En effet, le thème brain drain caractérise ici les études générales or, durant l'époque mentionnée, la question du brain drain s'est très largement articulée autour de la question des étudiants, lesquels représentaient le plus important mouvement de la migration des élites [14]. Que montre donc bien que la baisse des travaux généraux sur le brain drain s`est effectuée concomitamment à une augmentation des travaux sur les étudiants. Il y a là, selon nous une compensation que nous ne pouvons malheureusement pas affiner sur ce graphique.

On peut enfin observer sur ce graphique une forte progression, au cours des cinq dernières années, des trois courants qui participent au renouvellement du champ : retour, brain gain, mobilité scientifique.

Les principales approches disciplinaires

Les travaux, de nature économique (ou pluridisciplinaires mais à dominante économique), s'attachant à l'évaluation des coût du brain drain ainsi qu'aux problèmes de compensation entre pays, sont relativement peu nombreux par rapport à l'ensemble de la base (194 textes sur 1808 soit pas même 11 % de l'ensemble) pourtant ils ont dominé le débat, particulièrement dans les enceintes internationales. Les travaux sociologiques sont, quant à eux, plus nombreux (310), mais à part les travaux de l'Unitar (Glaser, 70 à 78 entre autres) ils n'ont pas marqué le débat de façon aussi prégnante que les travaux économiques (graphique 7).



Graphique 7. Chronologie des approches économiques et sociologiques

L'évolution sémantique du « brain drain »

Le terme de brain drain est apparu en 1963 dans un document de la Royal Society. Il cherche à « dramatiser » (Johnson, 1965) le mouvement de personnel formé (surtout des scientifiques et des médecins) quittant le Royaume-Uni et des rémunérations peu élevées pour les États-Unis où le marché demandeur offrait des salaires élevés. La notion de brain drain caractérisait donc alors très précisément le phénomène de déperdition du capital humain formé qui s'opérait en réponse à un appel du marché.

Le terme est ensuite repris, pour qualifier la migration des élites des pays du Sud vers les pays du Nord, mais le concept change tout en gardant sa dimension de « drainage » économique lequel, dans la foulée des analyses économiques tiers-mondistes, s'inscrit dans la continuité du pillage qui se fait au détriment du Sud (Amuzegar, 1968). Si le terme de « drain » garde sa connotation économique, le terme « brain » devient, lui, extrêmement malléable. Le « brain » est de moins en moins un « cerveau » formé mais un « cerveau » en formation car il qualifie souvent les étudiants migrants du tiers monde, (voir figure 6). Paradoxalement et concomitamment il représente de moins en moins un « cerveau » (dans le sens entendu des professions intellectuelles et scientifiques), car dans cette appréhension où l'économique prédomine (c'est en effet la notion de « drain » qui est prédominante), le terme de « brain » en vient à désigner tout professionnel dont la qualification peut faire défaut à son pays d'origine, donc, selon les études et les travaux, le terme peut aussi bien désigner pêle-mêle les artisans, les ouvriers formés ou autres personnels qualifiés.

Dès lors, le terme de « brain drain » ne qualifie plus une migration spécifique, celle de scientifiques ou d'intellectuels, mais définit un phénomène qui s'opère à travers une migration et qui stigmatise la déperdition réelle ou potentielle subie par le pays d'origine, en termes de compétences professionnelles (à n'importe quel niveau). Toutefois, malgré le glissement du terme, la question des migrations scientifiques (formés ou en formation) reste centrale au débat.

La controverse idéologique : des postulats économiques qui s'opposent

Toutefois les avis ne sont pas unanimes pour voir cette migration comme uniquement source de déperdition. D'aucuns, refusant d'analyser les migrations des élites professionnelles à partir d'un paradigme inspiré des analyses néocolonialistes, maintiennent l'idée que ces migrations restent bénéfiques aux pays d'origine, par les transferts de fonds qu'elles occasionnent, par le fait que les migrants influencent, par leur présence, la politique de leur pays de résidence au bénéfice leur pays d'origine [15], par la participation des expatriés de haut niveau au développement de leur pays grâce à un transfert de technologie (même lorsqu'ils ne retournent pas chez eux) (Grubel, 1966, Grubel et Scott, 1966b, Johnson, 1967 et 1968). C'est le début de ce que l'on a appelé « la controverse brain drain » (Das, 1971) où s'affrontent deux courants, s'inscrivant tous deux dans une perspective économique, les « internationalistes » et les « nationalistes » (Adams, 1968, Kindleberger, 1977). Selon les premiers la migration des compétences vers les pays du nord constitue un phénomène normal dans un marché international car elles vont là où leur rémunération et leur productivité est optimale (d'autant que dans cette conception la migration est censée rapporter autant de bénéfices au Sud qu'au Nord [16]). Les « nationalistes » appuient leur thèse sur deux postulats : 1) l'économie internationale ne permet pas une répartition équitable des compétences -lesquelles vont au Nord et font cruellement défaut au Sud-, 2) les mouvements migratoires des compétences sont artificiels car induits par les politiques migratoires sélectives des pays d'accueil, dans un objectif direct de profit (Amuzegar, 1968).

C'est la thèse « nationaliste » qui sera retenue comme base de réflexion pour l'élaboration des politiques internationales. Ainsi la définition du brain drain retenue par les Nations unies stipule que le phénomène « ne peut désigner qu'un courant migratoire dirigé tout à la fois du Sud au Nord - entre pays en développement et pays développés- et au profit des seuls pays industrialisés à économie de marché ». Les gouvernements ainsi que les organismes internationaux furent donc encouragés à rassembler des informations sur l'importance du problème afin d'y apporter une réponse (Grubel, 1976).

C'est ainsi qu'apparaît en 1974 le terme de « Reverse Transfer of Technology » (UNCTAD, 1974) développé par la CNUCED/UNCTAD qui situe clairement le débat sur le plan des politiques internationales de coopération. Selon ce modèle d'analyse, inspiré des théories « nationalistes » du brain drain, la migration des élites des pays du Sud « retransfuse » dans les pays

industrialisés les bénéfices de l'aide que le Nord apporte au Sud (d'où inversion du concept de transfert de technologie). L'objectif devient donc de calculer les pertes et de trouver des systèmes pour prévenir ou compenser ces pertes.

L'impossible recherche de compensations

Les premières mesures, dites de prévention avaient pour objectif de stimuler les pays exportateurs de « cerveaux » afin qu'ils puissent créer un environnement politique, économique, scientifique et social propice à réduire l'exode des compétences (Baldwin, 1970 ; Zhalan, 1977). Des mesures restrictives furent aussi proposées, elles visaient à la fois les réglementations d'émigration dans les pays d'origine afin de freiner les départs, et les réglementations d'immigration dans les pays d'accueil afin d'éliminer les mesures encourageant l'introduction dans les pays du Nord des élites venant du Sud (Böhning, 1977). Des mesures dites de restitution furent également proposées qui envisageaient le retour des élites formées (les pays d'accueil devant favoriser l'émigration temporaire mais non définitive des élites intellectuelles) ainsi qu'un système de compensation visant à remplacer par une aide technique du Nord vers le Sud tout départ de spécialiste du Sud. Toutefois la plus connue de ces mesures fut celle de la taxation (Bhagwati et Dellafar, 1973 ; Bhagwati, 1976), qui préconisait la mise en place de dispositifs fiscaux dans un but de redistribution.

Dès l'origine, ces mesures étaient vouées à l'échec car l'approche théorique qui servait à appuyer ces propositions était biaisée. En effet, elle présupposait, d'une part, que tous les migrants intellectuels s'expatrient pour des raisons économiques, ce qui n'était pas le cas (Johnson, 66 et 68 ; Glaser, 78, Böhning, 82) et d'autre part, qu'il existait une « correspondance entre le mouvement migratoire et les mouvements de capitaux, de produits, des salaires ou des prix » (Salomon, 73). Un troisième bais résidait dans la difficulté (toujours d'actualité) de mesurer les migrations de ces élites (contours du concept flou, appareillage d'observation des mouvements inexistant) car si les départs des pays d'origine pouvaient être enregistrés, les retours, eux, ne l'étaient pas. Ainsi, les conséquences du brain drain étaient largement surestimées (Johnson, 1966).

Ces différentes mesures n'eurent donc pas les effets souhaités et le plus souvent ne furent même pas applicables. Les mesures préventives, qui sont dans leur principe les plus radicales car elles visent à retenir les élites au pays en leur offrant des revenus attractifs et un environnement professionnel stimulant, peuvent difficilement être considérées comme des mesures transitoires, mais comme « le » but par excellence à atteindre. En effet, la mise en oeuvre de telles politiques exige au préalable un niveau de développement économique scientifique et culturel tel qu'il créerait *de facto* les conditions propices à la résolution du problème de l'exode des compétences (Keely, 1986).

Les mesures restrictives n'eurent pas plus de succès et furent quasiment inapplicables. Il aurait fallu en effet, pour qu'elles puissent atteindre l'objectif visé, que les pays d'origine renforcent drastiquement leurs réglementations d'émigration. Or cela aurait abouti à la mise en place d'un système policier et de contrôle que la plupart des États ne pouvaient (ni surtout ne voulaient [17]) mettre en oeuvre. Il aurait également fallu que les pays d'accueil acceptent de modifier leurs politiques d'immigration, or, ces dernières restent une prérogative exclusive des États et répondent à des choix tant géopolitiques, qu'économiques ou sociaux. De ce fait, aucune nation n'acceptera, dans l'état actuel des rapports internationaux, de modifier sa politique d'accueil des étrangers sur la simple injonction ou sur les conseils d'organismes internationaux.

Les mesures de restitutions ne furent pas plus heureuses dans leur application, relevant elles aussi du contrôle des migrations individuelles elles auraient exigé que chaque fois qu'un spécialiste du Sud s'installait au Nord, pression soit faite sur lui pour qu'il rentre, ou encore qu'un spécialiste du Nord remplace la compétence perdue au Sud. Il n'est pas difficile de comprendre que ce n'est pas sur ce genre de considérations que s'élaborent les politiques de coopération

du Nord vers le Sud et que d'autres paramètres géopolitiques priment. Ces mesures furent donc elles aussi un fiasco.

Les mesures compensatoires, principalement l'idée de taxation (Bhagwati) s'appuyaient sur la création d'un fonds au service du développement des pays d'origine. L'idée était de rembourser, pour chaque immigrant formé, le coût de sa formation. Toutefois ces mesures furent difficiles à mettre en oeuvre, tant sur le plan conceptuel que sur le plan de l'appareillage statistique à mettre en place (Mundende, 1989). L'option de la taxation s'épuisera donc d'elle-même, en même temps que le concept de « transfert inverse de technologie » (UNCTAD 87b), mais elle aura donné lieu à de nombreux débats et suscité de nombreux travaux entre 1973, moment où émerge l'idée, et 1987, moment où elle est définitivement abandonnée.

La carrière sociologique du brain drain

Parallèlement au débat sur les remèdes à apporter au brain drain (basé exclusivement sur une approche macro économique du phénomène), un autre organe des Nations unies (United Nations Institute for Training and Research - Unitar), commençait à examiner le phénomène du brain drain à l'aide d'outils sociologiques (la première publication du projet de l'Unitar sur le brain drain a été publiée en 1970). Cette démarche, qui se démarquait fondamentalement des perspectives économiques qui donnaient lieu à la « controverse » et aux tentatives de « remèdes », n'était cependant pas nouvelle pour analyser les phénomènes migratoires [18], et un bon nombre de références antérieures à cette date avaient utilisé des approches sociologiques pour traiter des sujets, souvent limités il est vrai, de la problématique du brain drain (voir figure 7).

Toutefois ces travaux allaient apporter une nouvelle vision du phénomène. Lorsque furent publiés en 1978 les résultats de cet immense travail (Glaser et Habers, 1978), unique en son genre pour le nombre de personnes enquêtées (6 500 étudiants) et le nombre de pays concernés (11), ils révélèrent certains aspects inattendus du brain drain (qui devaient faire référence pour les années -et même les décennies- à venir) démontrant par exemple que, contrairement aux postulats en vigueur, 1) les étudiants qui restaient dans leur pays d'accueil après leurs études projetaient quand même de rentrer dans leur pays d'origine, 2) que la plupart de ceux qui étaient déjà rentrés chez eux projetaient d'y rester, et 3) que ce n'étaient pas forcément les plus doués qui restaient à l'étranger. Donc, la migration étudiante qui avait été entre autres au coeur du débat sur le brain drain n'était pas forcément un « drain » car, dans l'hypothèse où les retours se réaliseraient (ce que l'étude, par ailleurs, ne prouvait pas) il ne s'agirait alors que d'une migration temporaire. De plus, par leur approche sociologique, les travaux de l'Unitar mettaient en lumière l'immense complexité des processus et des dynamiques migratoires et l'infinie variation des raisons qui amènent des individus ou des groupes d'individus à émigrer et à revenir [19].

C'était donc remettre partiellement en cause la notion du brain drain telle qu'elle servait de postulat à l'analyse économique du phénomène. Par ailleurs, grâce à l'envergure géographique du travail, les auteurs démontraient que le brain drain n'était pas et ne pouvait pas être un phénomène uniforme puisqu'il relevait d'une réalité sociale laquelle était forcément polymorphe car liée aux conditions politiques, sociales, économiques et culturelles prévalantes dans les différents pays. Il devenait, dès lors, évident que le phénomène s'exprimait différemment selon les pays et les migrations (nature, direction et importance des flux) et il apparaissait, en conséquence, que l'on faisait fausse route en préconisant comme traitement au brain drain des solutions globales telles que celles qui jusqu'alors étaient proposées sur la base des approches macro-économiques.

Toutefois si les travaux de l'équipe de l'Unitar permirent d'appréhender la complexité du fait

migratoire, ils ne remirent pas en cause (bien que la relativisant) l'idée d'une déperdition des compétences et des talents pour les pays d'origine. En effet, si les étudiants et les professionnels qui projetaient de rentrer au pays ne pouvaient pas mettre en oeuvre ce projet, la déperdition devenait alors patente. C'est pourquoi le retour fut logiquement considéré comme le meilleur remède contre le brain drain et que progressivement les mesures économiques globalement préconisées pour lutter contre ce phénomène cédèrent la place à des approches nationales variées, visant à apporter des solutions ad-hoc pour répondre à des situations précises, et cela principalement en termes de politiques favorisant le retour. Ce faisant, la perception que l'on avait des migrations des élites (étudiants et professionnels) renouait avec la perception première que l'on avait de ces migrations, à savoir qu'elles allaient favoriser le développement du Sud [20]. Ainsi les travaux de l'Unitar, laissant espérer le retour des émigrés en formation ou formés, réinscrivaient la migration des élites dans un processus de transfert de technologie et de compétences.

Le fléchissement de la recherche strictement économique (qui s'observe très nettement au graphique 7) n'a cependant pas entraîné la fin totale de ce type d'approche. Toutefois, celle-ci n'a plus la chambre de résonance que lui offraient les enceintes internationales. Par ailleurs il apparaît clairement que si le concept de brain drain en tant que phénomène de déperdition de ressources humaines pour le pays d'origine est bien sorti des conceptions économistes tiers-mondiste des décennies 70 et 80, il repart depuis le début des années 90 pour une nouvelle carrière où il revient à sa définition première, à savoir qu'il qualifie à nouveau une migration de personnel scientifique, de chercheurs et de techniciens de haut niveau déjà formés et qui partent à l'étranger principalement en réponse à une réalité politico-économique.

En effet, la multiplication récente des travaux sur le brain drain (lesquels sont de nature principalement sociologique, voir figure 6) correspond à l'intérêt croissant porté à la question des migrations scientifiques des pays de l'est et à la question du retour (parmi ceux-ci notons le grand nombre de travaux portant sur les étudiants chinois, voir figure 5). S'inscrivent également dans la montée en puissance des études sociologiques tous les travaux ayant trait à la mobilité scientifique et au brain gain (6). Ce qui est cependant notable c'est que le terme même de brain drain n'est que très rarement remis en cause et il suffit de regarder les travaux récents (les travaux du Roste en sont une bonne illustration) pour comprendre que la migration de personnel de haute qualification est toujours considérée comme une perte pour le pays d'origine.

Vers de nouvelles perspectives : conjointement au retour des cerveaux, l'option diaspora

La période récente aura toutefois été marquée par deux approches qui ont contribué à ouvrir de nouvelles perspectives : le retour des cerveaux (nous l'avons abordé précédemment) et l'option diaspora (Meyer, Charum, 1995) [21]. En effet, la décennie 1980 a vu se développer, parallèlement à l'étude des pertes occasionnées par les départs, le concept symétrique de « retour des cerveaux » ou de « retour des compétences » [22]. Les « petits dragons » du sud-est asiatique sont les champions du retour.[23] Les politiques ainsi mises en place dès les années 60 et 70 visent la réintégration systématique des nationaux formés à l'étranger [24]. Parmi ces derniers, ce sont probablement la Corée du Sud et Taiwan qui ont mis en place les politiques de rapatriement les plus volontaristes (Chang, 1992 ; Yoon, 1992 ; Song, 1991).

L'efficacité de ces politiques est restée très limitée au cours des années 60 et 70. Pour prendre l'exemple de la Corée, ce n'est qu'à partir des années 80 que l'on a pu observer d'importants taux de retour de chercheurs et d'ingénieurs expatriés aux États-Unis (Song, 1991). Le cas de la Corée, comme celui d'autres pays nouvellement industrialisés de la région, illustre fort bien le fait que le retour des élites scientifiques et techniques est pour une large part lié au déve-

loppement économique du pays, accompagné du développement d'un système national de recherche performant [25], et qu'il est étroitement dépendant de la densité et de la qualité des échanges existant entre le pays d'origine et la diaspora intellectuelle expatriée [26].

L'option diaspora consiste à reconnecter les chercheurs nationaux vivants à l'étranger avec la communauté scientifique nationale autour d'activités scientifiques d'intérêt commun. Ce n'est toutefois pas une politique complètement nouvelle. Ce qui est nouveau, c'est le maillage systématique rendu possible par le développement de techniques modernes de communications qui permettent une configuration démultipliée et plus extensive devant aboutir à un nombre de relations et d'échanges entre les membres de la diaspora beaucoup plus nombreux. Un nombre croissant d'initiatives ont ainsi été prises au cours des dernières années par plusieurs pays pour répertorier, mobiliser, organiser et re-connecter leurs chercheurs expatriés avec la communauté scientifique présente sur le territoire national. C'est notamment le cas du Chili, de la Colombie, de la Corée du Sud, de l'Éthiopie, de l'Érythrée, de l'Inde, d'Israël, de la Roumanie, de Singapour, de Taiwan et du Venezuela (Gaillard, Meyer, 1996). Parmi ces différents pays, c'est probablement la Colombie qui offre, avec son « réseau Caldas », un des exemples les plus avancés de tentative de re-connection des chercheurs expatriés (Charum, Granes et Meyer, 1996).

Cependant, si l'idée paraît simple et séduisante, la mise en oeuvre en est plus complexe (Meyer, Gaillard, Schlemmer, 1995) [27]. Tout d'abord elle recèle une contradiction interne car le modèle repose sur un double postulat : d'un côté, celui de l'universalité de la science et de l'autre, celui qu'il existe chez les chercheurs expatriés un sentiment d'appartenance nationale. Or, l'observation montre que plus les chercheurs se considèrent comme des scientifiques, plus ils ont tendance à vouloir utiliser le réseau de la diaspora comme un réseau scientifique international, privilégiant l'échange avec leurs pairs et n'accordant pas grand intérêt aux collègues hors de leur champ, quand bien même ces derniers seraient des nationaux, car la science n'a pas de frontières... A l'inverse plus ils se sentent appartenir à une nation, plus ils cèdent à la tentation de transformer le réseau de la diaspora en réseau d'échange et d'entraide, diluant son potentiel strictement scientifique et technique (Schlemmer *et al.*, dans cet ouvrage)

Toutefois, l'option diaspora reste, avec le retour, une des solutions les plus prometteuses pour lutter contre les effets négatifs du brain drain tout en tirant partie de celui-ci. Rétrospectivement, il est d'ailleurs intéressant de noter que cette approche renoue avec un des thèmes récurrents du passé, celui du développement du pays d'origine par le moyen de ses élites expatriées. Ce fut le principe dominant du concept de « transfert de technologie » attaché aux études à l'étranger, ce fut un des thèmes chers aux « internationalistes » des années 1970. Il apparaît d'ailleurs qu'un consensus se fasse actuellement autour de cette idée, et il n'est pas anodin de constater que des personnes qui pendant longtemps se sont inscrites dans le courant nationaliste reconnaissent maintenant l'opportunité que représente, pour les pays d'origine, les migrations de leurs élites à l'étranger. Bhagwati qui, dans les années 73-75 était un spécialiste reconnu des études sur les systèmes de taxation et de compensation écrivait en 1994 « Ces pays (les PED) ont eux-mêmes changé d'avis... De plus en plus ils voient dans cette émigration de leurs ressortissants les plus doués une occasion pour ces derniers de se distinguer et de contribuer à la gloire de leur pays d'origine... Ces pays espèrent utiliser à leur avantage les talents de leurs ressortissants à l'étranger. Bref, le schéma en cours aujourd'hui n'est plus celui de la fuite des cerveaux, mais plutôt celui de la diaspora » (Bhagwati, Rao, 1994).

Toutefois l'option diaspora va plus loin. Elle devient un choix politique de plus en plus volontariste. C'est une tentative de la part des pays d'origine pour accéder aux compétences multiples (professionnelles mais aussi relationnelles) de leurs élites expatriées. C'est donc, dans un contexte de mondialisation de la science et des moyens de communication, tenter de valoriser et de réinjecter au niveau national les bénéfices découlant des travaux des scientifiques expatriés, ces derniers devenant les postes avancés et les moyens d'extension d'une science nationale.

Toutefois c'est une option qui ne peut vivre seule et, si elle est indispensable à la réussite des politiques de retour, elle a tout autant besoin des flux de retours pour s'activer et se renouveler. En effet, plus les élites professionnelles s'inscriront dans un réseau actif de diaspora et participeront à des associations leur permettant de se reconnecter et de garder le contact avec leur communauté professionnelle du pays d'origine, plus facile sera leur décision de retour le jour où l'opportunité s'en présentera (Song, 1997). En contrepartie, plus les professionnels rentreront au pays, plus grande sera l'interface entre les communautés professionnelles locale et la diaspora. A terme, ces retours de plus en plus nombreux permettront de réduire les écarts existants entre les domaines d'activité scientifique et technique au niveau national et ceux dans lesquels les expatriés sont opérationnels. Ainsi ces retours participeront au renforcement et à la diversification des communautés scientifiques nationales, renforcement et diversification indispensables au maintien et au développement de l'option diaspora elle-même.

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[4] Le plus souvent en rapport avec des informations relatives à l'observation des communautés scientifiques au sein desquelles vivent et travaillent les auteurs. En cela il ne s'agit pas à proprement parler d'études scientifiques sur le sujet, mais plutôt d'observations ou de témoignages qui sont, la plupart du temps, autant de manifestations d'inquiétude.

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[6] Notice dans laquelle sont données les informations concernant les différents supports de la publication : « aussi publié en... sur... etc. »

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[9] Deux travaux référencés traitent de l'Afrique comme pays d'accueil, un texte général et un texte sur le Nigeria.

[10] Unesco Statistical Issues, 1993.

[11] Sur les 104 références publiées avant 1965, 27 l'ont été avant 1960.

[12] Le fait que le total des courbes ne correspond pas à la courbe de la totalité des textes s'explique par le fait que certains textes traitent à la fois du pays d'émigration et du pays d'immigration.

[13] Nous avions par exemple défini d 'autres courants comme Brain Overflow, Brain Drain pour le pays d'accueil, Politiques et programmes..etc. que nous avons finalement abandonné dans l'analyse finale.

[14] À partir de 1970 on a assisté à une augmentation considérable du flux des étudiants vers l'étranger. Cet accroissement fut de 95 % durant la décennie 1970 et de 29 % dans la décennie 1980 (pourcentages calculés d'après les chiffres de l'Unesco publiés en 1993 et indiquant l'accroissement du flux de la décennie par rapport à celui de la décennie précédente).

[15] Précédant en cela l'idée de plus en plus répandue actuellement sur le rôle politique des diaspora dans les pays d'accueil. (Bhagwati et Rao, 1994)

[16] Dans ce contexte M. S. Das (1971) parle déjà de substituer au terme « brain drain » les termes « brain gain » ou « brain exchange ».

[17] Les États qui avaient fait le choix politique d'une régulation drastique de l'émigration de leurs élites (pays de l'Est par exemple) n'étaient pas des modèles de démocratie et n'avaient pas eu besoin des recommandations des experts internationaux pour la mise en oeuvre de telles mesures.

[18] Les sociologues du Département d'écologie urbaine de l'École de Chicago avait largement expérimenté les méthodes sociologiques (parmi d'autres) pour l'analyse les migrations dès le début du siècle (1914-1930).

[19] Les travaux de l'Unitar inspireront également nombre de travaux réalisés au cours de le décennie suivante tant sur le phénomène de l'exode que sur celui du retour.

[20] Après les indépendances, l'idée que la formation des élites dans les pays du nord allait favoriser le développement au Sud a été longuement prévalente et s'est maintenue parfois très longtemps dans les pays du Sud (Maliyamkono, 1980), et cela malgré le développement du modèle « nationaliste » selon lequel la migration des élites du Sud équivalait à un pillage économique de leur pays.

[21] Meyer J-B., Charum J., 1995, La fuite des cerveaux est-elle épuisée? Paradigme perdu et nouvelles perspectives, Cahiers des Sciences Humaines, 31(4), 1004-17, p. 1015 (note des éditeurs scientifiques).

[22] Deux organismes internationaux financent également depuis une vingtaine d'année des projets d'aide au retour des migrants qualifiés dans leurs pays d'origine, avec des succès inégaux : le Comité intergouvernemental pour les migrations (CIM) et le programme Tokten (Transfer Of Knowledge Through Expatriate Nationals), administré par le Pnud.

[23] Meyer, Charum, op. cit., p. 1009 (note des éditeurs.scientifiques)

[24] Les travaux récents réalisés sur le brain drain à Taiwan et en Corée du Sud, montrent toutefois que le brain drain, notamment vers les États-Unis, est avant tout une migration d'étudiants et non pas un exode de chercheurs et d'ingénieurs qualifiés (Chang, 1992).

[25] En supprimant les aides au retour de leurs scientifiques et ingénieurs expatriés dès le début des années 90, la Corée reconnaissait de fait que ces dernière ne jouaient plus un rôle prépondérent dans la décision du retour. Elles furent entre-autres remplacées en 1994 par un programme baptisé « brain pool » qui permet aux institutions de science et technologie coréens d'inviter pour des séjours, limités en général à un an, des chercheurs et ingénieurs résidant à l'étranger (Song 90).

[26] Concomitamment à la mise en place du « brain pool » le gouvernement coréen a renforcé son soutien aux associations de scientifiques et d'ingénieurs coréens à l'étranger, lesquelles ont établi et alimenté des bases de données qui servent d'interface entre la demande nationale en expertise en science et technologie et les chercheurs coréens résidant à l'étranger (*Op. cit.*).

[27] Meyer J-B., Gaillard J., Schlemmer B., 1995, Nouvelle approche des migrations scientifiques internationales, Chroniques du Sud (Orstom), n° 15, 59-72, p. 64 (note des éditeurs scientifiques).

Brain Drain: an Historical and Conceptual Framework

Enrique Oteiza

Introduction

This denomination refers to the quantitatively numerous international migration of people with high educational qualifications and was coined originally in the English language from which it has been translated into various languages. As “brains” or talents is understood in the context of this denomination, the people who have high intellectual qualifications, such as scientists of social or natural sciences, university graduates in humanities, professionals of a university level and other creators of a similar level. The notion may be identified to a good extent with that of “intellectuals”, although it has been used more frequently with a more restricted universe, that of the scientists and technologists, specially those who engage in research and in general in the creation of advance knowledge in their respective areas [1].

Dictionaries and encyclopedias specialized in social sciences, for example the “International Encyclopedia of Social Science”, directed by David Sills, published by The MacMillan Company and The Free Press in New York, or “A Dictionary of Social Sciences”, directed by Julius Gould and William L. Kolb, also published by The Free Press, do not make any reference to this concept under the name of brain drain or any other. This lack of inclusion of a denomination that refers to an important concept in the study of international migratory processes, analyzed by numerous authors of various disciplines, represents, no doubt, a curious omission. Already in 1976 Stevan Dedijer published an important bibliography titled “Brain Drain and Brain Gain, a Bibliography on the Migration of Scientists, Engineers, Doctors and Students”, Research Policy Program, Lund University, Sweden.

The massiveness and continuity that this migratory phenomenon has acquired, is the result of an intensive use that industrially and scientifically advanced countries make of highly qualified human resources, whose education implies an investment of at least 20 schooling years (in the case of Science and Technology researchers), which takes up a strong social and individual investment, as well as long gestation periods.

Historic Background

In order to understand the specific nature of this type of selective migration called brain drain, and appreciate its differences with prior migratory phenomenon, it becomes useful to go over, although briefly, some of those phenomena, interesting because of the importance that they had at their time.

In the history of science and university (for example in the known texts : G. Sarton, A History of Science, Oxford University Press, 1953 ; C.A. Parsons, The Alexandrian Library, Elsevier, Amsterdam, 1952 ; F. H. Powicke, A. B. Emden, Rashdall’s Medieval Universities, Clavendon

Press, Oxford, 1936; H. Waddell, The Wandering Scholars, Constable and Company., London, 1927), two important aspects of the migrations of outstanding scientists and intellectuals stand out. The first one refers to the high mobility of the people with high intellectual qualifications, with respect to other groups of their respective societies of origin; and the second one is represented by the role that the explicit attraction policies have played in these movements.

In order to mention only some examples, it is convenient to remember that Athens became the center of attraction for wise men and philosophers in an increasing manner as of the foundation of the Academy by Plato, in 388 B.C., and later by Aristotle's initiative, of the Lyceum, in 335 B.C., within a political and cultural context favorable for this type of activities that innovate thinking. Around 300 BC, the center of attraction of migrant scientists moves to Alexandria as a result of the firm policy shown by the first kings of the Ptolemaic dynasty and maintained then by the Egyptian governors for hundreds of years.[2] The means of life offered to the numerous scientists attracted to this center of study and research, and the possibilities for work built around the Library and the Museum, represented unique conditions in the world of that time for research and intellectual creation tasks.

In another historic period, in Europe, as of the 9th Century, the appearance of the Universities of Bologna -the first one- and then the Universities of Paris, Salamanca Oxford and Krakow, produce important migrations of students and professors attracted from all the corners of the Continent to those study and research centers. The secessions, various conflicts and political and religious crisis, produced important migrations of professors among European universities which increasingly multiplied throughout that period, thus resulting in new study houses being founded at the initiative of dissident groups that were expelled from the pre-existing study houses, with the support of local authorities interested in being benefited from those immigrant "wise men".

It should be pointed out that contrary to the current phenomenon of brain drainage, which has permitted some countries to incorporate highly qualified immigrants in amounts that go up to hundreds of thousands during the past five to six decades, the previous migratory processes to which we have referred to involved, in the best of cases, only a few hundred outstanding personalities form the intellectual world of the time. Also significant is the difference regarding the connection between the generation of new knowledge and its application to the economic activities. Current qualified migrations to advanced industrialized countries, insert themselves in research processes increasingly articulated with the goods and services production activities, which did not occur prior to the last two centuries.

Regarding the central countries, it should be remembered that as of the Renaissance deep transformations occur in the urban and rural life in Europe, accompanied by not very peaceful changes of the political and social structures of the Continent. These transformations and dislocations strongly mark the nature of the international migrations of the time. This wide and complex process of change at a European level, accompanied by the construction of new empires with wide dimensions and the extension later of these changes to the United States and other parts of the world, produced various types of massive intercontinental migrations. The most relevant of these for Latin America were those that accompanied the Spanish and Portuguese conquest, after the traffic of slaves in the 15th, 16th and 17th centuries and later the massive European emigration which occurred during the 18th and 19th centuries.

The traffic of slaves was a process of forced transatlantic migration, started by the Colonial European powers, resulting in an African emigration to America estimated at a little over 15,000,000 people who arrived at this continent from the beginning of 1600 and 1830.

Regarding the European migrations during the past century and the first thirty years of the current century, it is estimated that around 60,000,000 people departed form Europe in that period, most of whom went to America (North, Center and South America) and to a lesser extent

to Oceania and other continents (Carr-Saunders, Alexander M., World Population : Past Growth and Present Trends, Oxford, Clarendon Press, 1936). This intercontinental migratory phenomenon was then of an unheard of extent, not maintained at a similar rhythm after 1930. Not only the increase in the growth rate of the European population and the deep social transformations occurred in that continent were the sole causes of this massive exodus; capital investments accumulated in the north of Europe, intended for America and other parts of the world and the transfer of technological knowledge, represented important additional factors in the process of population transplant, coming also from Europe, but from the zones that became marginal as a result of the "modernization" process, or expelled out by wars, dictatorships and other forms of religious, political or ideological persecution. The massive nature of this migration resulted naturally in the transfer of a number of highly qualified people - university professionals, artists, etc. - presumably in a proportion not higher than that of its participation in the economically active population existing in Europe, during this period.

Once again in the two cases mentioned above important differences are observed with respect to the migratory phenomenon called brain drain. In the case of the trade of slaves it was exactly a selective migration, but opposite to the current migration of high educational qualifications. Slavery consisted of the forced recruitment of manual workers with little o no "schooling" qualifications in European terms, for the performance of forced labor. With respect to the international migration of an European origin of the last century and beginning of the current one, it was, contrary to the brain drain, a massive process, not selective, with respect to the qualifications of the migrants.

Selective Migrations

Industrialized Europe and later the United States disseminate and expand their economy, in a process of hegemony domain, through colonial and neocolonial empires and established by various metropolis and, later, in an increasing manner by the control of the financial system and the construction of technological monopolies operated basically by the so called "multinational companies", until the well known characteristics of the current globalization is reached - with a center (North) of industrially and scientifically advanced countries and a periphery (South) of semi, little or not industrialized countries -the latter with very limited scientific development, in the best of cases-. In this phase of the long historic globalization process, contradictory tendencies are observed towards regionalization with integration of national on the one hand, and national disintegration, on the other[3]. The dynamics include increasing social gaps between the North and the South, as well as within almost all the countries of the world.

It is as of the World War I that the countries of origin and destination of the main international migratory flows, start to define and apply to a greater extent, policies intended to retain or attract people with certain qualifications in accordance with their respective interests. The world crisis of 1930 caused a relative closing of immigration by several countries which up to that time had been the main receivers; notwithstanding this the political and economical situation of Europe continued encouraging the exodus. But only after World Word II the selectivity of international migrations is extended and perfected, producing a real drain of highly qualified people from less developed countries to others industrially and scientifically more advanced.

Characterization of “Brain Drain”

The type of migration referred to by this study represents, then the transfer from one country to another, or to several other countries, of significant numbers of people who have a high level of instruction usually obtained from formal education systems of the country of origin of the migratory current. In general, included in the definition of this type of selective migration are the people who have obtained at least the first university degree in the country of origin. Artists in their condition as such may be included in the migration of high level human resources, even when they have not reached this first university degree. In some countries where professional associations play an important role of accreditation, it would be possible to include also certain people who are not artists or who do not have a university degree, provided that they had been admitted by such associations.

The “brain drain” has distinctive characteristics which fully appear as a post World War II phenomenon. It has its origin in a clear awareness by the governments of the central countries (first the USA and later Western Europe), about the value incorporated into human resources with a high level of formal education and training in certain specialties, in order to secure economic, social and cultural development. The importance assigned to research in science and technology in industrially advanced countries (in those countries approximately 2 % of the GNP is invested in science and technology research), an activity of great intensity in the use of high level human resources, encourages considerably the demand for highly qualified people.

Until just a few years ago some advanced countries of the OCDE made projections of the occupational structure with a perspective from ten to five years, in order to estimate the number of people in the economically active population that will be required with different types of specialization and levels of formal education, in order to orient the educational strategy and satisfy this way various national objectives. In this manner, such countries determined what is currently known as the future demand of human resources necessary for a certain type of national development.

The United States, Canada, Australia and most countries of Western Europe used and still use this type of analysis to define their selective immigration policies. Currently, the employment crisis and the uncertainty regarding the outlook of the economic growth, have contributed to reduce the optimism with respect to the usefulness of this type of exercises, although selective immigration policies are indeed maintained and various forms of discrimination with respect to the mobility of people are increasing at an international level when this involves a change regarding the country of residence.

Upon the definition by the central countries of the above mentioned policies, a migratory current of high level human resources developed between those countries and some underdeveloped countries with availability of people trained to a good level in the specialties required by the former. These currents move in many directions and between pairs of countries, but according to speculative data available, it is confirmed that the net flow between two countries goes from the less developed countries to the more developed ones, and that the pattern of international migratory flows is defined and relatively stable. It has a structural background and involves a well defined group of countries. Observing the speculative data on net migratory flows of high level human resources, it is possible to identify four groups of countries according to their position with respect to this type of migration. For each one of these four one or more countries will be taken for illustration purposes :

a) For example : The United States. Very important entry of highly qualified immigrants. Insignificant exit of equally qualified emigrants who leave The United States. From a “brain drain” point of view, The United States may be considered as a terminal station. This country is a great net importer of high level human resources.

b) For example : England and Canada. Considerable entry of highly qualified immigrants that come from less developed countries, former colonies and other countries of Eastern Europe and form the South. Considerable departure of equally qualified emigrants that leave those countries to go to the United States and in the case of England, also Australia, New Zealand and other European countries. From the point of view of "brain drain", the countries in this situation may be considered in a wide sense of the term as transit stations, since they have a net balance which fluctuates sometimes becoming exporters and others net importers of high level human resources.

c) For example : Argentina (countries relatively less industrialized). Reduced entry of highly qualified immigrants and important exit of qualified emigrants, who go mostly to the United States, to some European countries and to Israel. This type of countries are net exporters of high level human resources.

d) For example : India (underdeveloped countries). Insignificant entry of immigrants with a high level of education and important exit of emigrants with the same characteristics, mostly towards England, Canada, United States and the rest of Western Europe. A country of this type is net exporter of human capital to a greater extent than the preceding countries.

The existence of selective immigration systems in highly industrialized countries in a world where there are great disparity in the degree of economic and scientific development between these countries and the underdeveloped countries, generates important migrations of human resources with a high training level. These selective emigration systems permit the more advanced countries to solve their shortages of highly qualified work force, in the short and medium term, in occupational categories in which the number of university graduates of several specialties is anticipated that will be insufficient ; this is, naturally, only one of the issues of the problem. At the long term, the flows of the various specialties produced by the education system, may be adjusted by means of planning or educational expansion measures taken internally by the government in order to fill the gaps covered temporarily by the selective emigration. In an emigration system of this type permanent or resident visas, which are the ones that allow the entry to the work force of the country of destination of the emigrant, are agreed according to the criteria of shortage of highly qualified labor determined above, or at the direct request by universities, research institutions or companies ; their assignment on the part of the state constitutes a mechanism through which selectivity is controlled.

Naturally, the shortage or abundance of offer of a certain type of high level human resources, is a concept that may be or has been interpreted in various ways. However, the method which considers the requirements of human resources with respect to national objectives seems to be, until now, the ruling principle in the determination of selective immigration policies, year after year. The immigration policies continue having national characteristics even within the on going regionalization processes.

An important characteristic of the emigrant with a high educational level, as it was observed before, is his mobility. A person who has pursued university studies, especially if made in the peripheral country of origin in an institution with high educational quality, according to the measuring patterns of "developed" countries, can speak at least one foreign language, normally one of the languages of industrially advanced countries. This type of highly qualified person also reads regularly the most relevant foreign technical publications of his specialty, participates in international meetings and knows which are the key places regarding the development of his field of work. The contacts with what economically can be considered an imperfect international market of the work factor, are facilitated in this case due to the relative decrease of transportation costs, which in turn facilitates the eventual emigration. The mobility and information seem to be greater in fields such as science, engineering and medicine, in which the demand on the part of advanced industrialized nations has been very strong in the past decades.

In tables 1 and 2 Brinley Thomas (Brain Drain, pages 75 and 81, Editorial Paidos, Buenos Aires, 1971) illustrates already at that time, about the magnitude of selective migrations to some of the main receiving countries. These data are significant of the impact of the establishment of selective migration systems on the part of the countries of the North.

Table 1. Relative magnitude of the currents of professional immigrants in the major receiving countries (for the period during which selectivity is consolidated and perfected -towards the end- in those countries)

	U.S.A. 1947-1965	**Canada 1946-1965**	**Australia 1949-1966**
Total immigrant workers 1,098,567	2,208,405	1,314,878	
Professional and technical personnel	372,204	145,501	90,438
Percentage of professionals and technicians on the total of emigrant workers	16.9 %	11.1 %	8.2 %
Percentage of professionals and technicians on the total	22.0 %	22.4 %	9.5 %

Note : The classification "Professional and technical personnel" is not exactly comparable for the three countries.
Sources : Annual reports by the Immigration and Naturalization Service, Department of Justice, Washington, D.C., U.S.A. Annual Reports from the Citizenship and Immigration Department, Ottawa, Canada. Australian Immigration : Consolidated Statistics, Camber, 1966.

Comparing in Table 1 the selectivity of emigration of three important receiving countries, USA, Canada and Australia, it is observed that for the first of them, during the period 1947 to 1965, there is an advantage in the proportion of gross immigration of professional and technical personnel, which reflects a greater relative selectivity capacity on the part of the receiving country as refers to qualifications. With respect to the comparison of the emigration figures of professional and technical personnel, the difference with the USA increases considerably if we consider that Canada undergoes an important emigration flow of highly qualified people towards the USA (see migration statistics, Canadian Labor Department).

Table 2 illustrates especially the relative magnitude of the contribution made by various countries and regions of origin of highly qualified immigrants that in terms of number of people entered the USA. Years 1962-1964 also illustrate the perfecting of the immigration selectivity policy, since they take the periods immediately preceding and following the application of the new immigration law of the USA passed in 1962. Table No. 2 clearly shows how in the mid 60's, especially as of the passing of this new law, the poorest underdeveloped countries such as those of Asia, increase their qualified migration contribution.

Table 2. Scientists and Engineers admitted to the USA as immigrants according to birth countries or regions, 1962-1964*

Birth country or region	**1962**		**1963**		**1964**	
	Number	%	Number	%	Number	%
Europe	2,431	56.6	3,002	50.6	2,982	51.8
Germany	356	8.3	428	7.2	491	8.5
Great Britain and Northern Ireland	925	21.5	1,153	19.4	1,175	20.4
Canada	526	12.2	633	10.7	685	11.9
Cuba	289	6.7	198	3.3	236	4.1
Mexico	58	1.4	61	1.0	55	0.9
South America	219	5.1	327	5.5	426	7.4
Asia	498	11.6	1,406	23.7	1,053	18.3
Other origins	276	6.4	306	5.2	325	5.6
All countries	4,297	100.0	5,933	100.0	5,762	100.0

* This table includes social scientists: 192 in 1962, 231 in 1963 and 283 in 1964.
Source: Scientists and Engineers from Abroad, 1962-64, NSF 67-3 (Washington, D.C. : National Science Foundation, 1967), p. 5.

Some Fundamental Issues Regarding “Brain Drain”

The neoclassic economic analysis of the brain drain exodus, such as those by Harry Johnson, part from the traditional premises of the theory of international economy, building conceptual -formal- models in which it is assumed that the free mobility of the production and product factors among world economies, as a function of the maximization of the benefits of firms and people -economically measured-, results in the highest degree of satisfaction possible of a well-being function worldwide (basically, only the increase of the product’s maximization is taken into account, disregarding whether the benefits flow or not, whether they are properly or improperly distributed, whether the knowledge generated has a free circulation or is monopolized by fact or law). Therefore, as refers to highly qualified people, the authors of this orientation encourage the maintenance of current mobility -as if it were free- in statements of an “internationalist” nature.

The main fallacy of this type of reasoning consists in the fact that in the world of the last few decades and in the current world, there is no free mobility of production factors (there are no free migrations of individuals but selective migrations operated by a few receiving countries), or free circulation of technology. There is not either any type of acceptable mechanism of distribution or redistribution of the benefits produced by the world’s economy, since through varied monopolistic practices and dominant management based on various forms of concentration of power, advanced countries appropriate of a very high proportion of the world’s wealth. These mechanisms of concentration of various forms of power : economic, military, technological, etc., have lead, at an international level, to a situation where the gaps existing among underdeveloped and advanced countries, have but increased since World War II - in the last decade and a half the social gap also increases within the countries of the North.

It is exactly within this network of international flows of factors, goods and services and of the manner how this network has been gradually configured as of the industrial revolution, that the analysis and interpretation of the brain drain should be framed. The so called unbalanced exchange between the ‘center’and the ‘periphery’is, by nature, firmly anchored in the characteristics of the international economic structure which from industrially advanced countries articulates the semi-industrialized countries and those openly underdeveloped. The brain drain has contributed in a concrete and not insignificant manner to the expansion and consolidation of the creative capacity in the field of science and technology of central countries, and within them very specially the United States. Given the scientific and economic organization of these countries, where the knowledge generated is rapidly incorporated to the productive machinery and taking into account their world power, the technology generated in the ‘center’with the help from immigrant scientists and technologists, feeds a network of asymmetrical exchanges which, in turn, increases continuously the differences between rich and poor countries. The knowledge transformed into technology permit the large corporations of the United States, Europe and Japan to establish monopolies and technological advantages later exploited in a multinational manner for the benefit mainly of privileged social groups, a lot more numerous in the central national corporation.

The approaches of a ‘national’type are an understandable reaction to the ambush that on this subject is implied, for the underdeveloped countries, by naive internationalism, although for other reasons it can also lead to wrong analyses of the selective migrations phenomenon. It is obvious that problems of an almost worldwide scope, determined to a great extent by central countries, can not be correctly analyzed only within the limits of the national scope of a peripheral country origin of the certain migration.

As refers to the mechanism that triggers the decision to migrate made by the emigrant, its proportions are multiple, and for this reason it can not be understood through a purely economic approach. The decision to emigrate is not made in abstract, nor it consists simple of the decision to abandon a certain country, but it arises form a concrete comparison of the perception that the potential emigrant has of his situation in his country of origin, and the comparison that he makes with his perception of the prospects that will be available to him in the other country, the country of destination.

The migratory situation is to an important extent structurally defined at the international level, but the decision of the person who emigrates implies the act of making a comparison between the perceptions that the emigrant has of the two situations, the present one in country A and the future situation in country B. For the analysis of the psycho-social motivational dimension of migrations, the approach through differentials of factors that are compared through the countries of origin and destination is more adequate than the disintegrated analysis of a 'push'and 'pull'type which is used in many studies.

The most relevant factors to be compared within an analysis of differentials between the country of origin and the country of destination, are as follows : difference of actual income ; difference of work means (logistic support) ; difference of social recognition to the respective specialty ; differences as refers to sociopolitical variables such as respect for the political-ideological position of the emigrant, possibilities of political dissent, repression, academic freedom, etc. At this level of the analysis there are also structural characteristics of the world system that appear such as those that determine to a great extent the differences between the mentioned factors. Therefore, the comparative differential that by motivation moves the decisions to migrate is the triggering factor of the migratory offer from where advanced countries select the qualified immigrants in the number and quality necessary by means of a rational selective system (passes/does not pass), operated by receiving countries.

There is, however, a maneuver margin for underdeveloped countries and even greater for semi-industrialized countries, to deal with this type of costly exodus. In the first place, it can not be ignored that in these countries there are sometimes extreme ideological and political persecution processes, both internally and induced from outside (for example, the repression applied in Latin America through the Hemispheric National Security Doctrine for several decades) partly as a result up to 1989 of the cold war, which favored the emigration of qualified people and in some cases produced an actual expulsion.

Secondly and more commonly, the development mode with dependent industrialization, customary in underdeveloped countries, does not generate the effective demand for new knowledge that could be produced by local scientific-technological research, and thus the latter is developed at a small scale and without a real social foundation.

Third, the educational systems of underdeveloped countries are imitative to an important extent as refers to the curricula, contents, orientations and texts, and thus their graduates many times are better prepared to work and face the problems of central societies than those of their own countries of origin.

As a final comment it may be stated that the brain drain is a negative migratory phenomenon for Latin America and in general for less developed countries and regions. Not only these countries lose the economic and social investment they have made to train those who later leave to make their social and economic contribution to central countries, but, in addition, this type of selective migration strengthens the structures that expand and perpetrate the various forms of unequal exchange, which leads to making the differences between poor and rich countries even deeper.

Balance of the Emigration of Science and Technology Researchers in Argentina

The combined effect of the lack of a coherent policy of human resources for the Scientific and Technological Complex, within a framework of political and economic instability, anti-democratic and repressive military regimes, interventions and university weakening and lack of appreciation of national talent on the part of productive sectors, is expressed in the case of Argentina in a costly phenomenon of emigration of highly qualified researchers [4].

Thus, the brain drain not only affects in Argentina the complex of activities of scientific and technological research, but in general the possibility to accumulate creative capacity in the entire society, which naturally assumes, for those who unlawfully retain power, to accept and appreciate the possible existence of a critical thinking.

The phenomenon of selective emigration already starts to draw the attention of people interested in the national scientific and technological development and of scholars who study the migratory problems in our environment, at the beginning of the 60's. Thus it was possible to observe from our reality that as of World War II, industrialized countries of the North started to apply selective migratory policies in a systematic manner, in order to attract highly qualified scientific and technical personnel, human resources that those countries consider strategic for their development. Throughout more than three decades, our country followed the reverse route, producing a strong exodus of researchers, due to the perverse effect of the factors that we have already mentioned.

This unfavorable picture took place in a context of lack of interest and labor demand in scientific and technological research on the part of the dominant political elite and the productive sectors of goods and services, of a low social recognition of researchers and university professors and of a policy of low compensation to scientists and technologists. These negative circumstances have produced the exceptional situation for a developing country of an intermediate level, such as Argentina, of having approximately 15,000 university graduates abroad, in an expatriate population that can be estimated from 800,000 to one million people. Taking into account the selectivity in the granting of immigrant visas which is applied by most countries that receive our exodus, and the data that result from the studies carried out, it may be estimated that there are from 30,000 to 50,000 Argentinean scientists and technicians of university level abroad, some of them with outstanding qualifications. The extent of this loss may be rapidly measured if we take into account that active researchers in Argentina are less than 15,000, if we include in this estimate those who theoretically perform full time scientific and technological tasks, either as researchers or as professors researchers, and that at the current time reforms are being made in the Sector of Scientific and Technological Research which will result in a reduction of the preexisting capabilities (as a result of the advisory and the pressures from the World Bank).

On the other hand, if we apply the lowest figures estimated by developed countries as the social cost of producing a researcher in science or technology who just starts his career, the result is that even assuming that there would be abroad 30,000 researchers, the country would have lost as educational investment a minimum of US$1,500 billion dollars (not considering the cost of the training of researchers after graduating from the university, or the cost of university graduates in other specialties not included in this estimate).

Naturally, both in terms of time and in terms of investment, the cost of losing leaders from good scientific or technological "schools", in a certain specialty, is a lot higher. Likewise, the rupture of generation chains between senior researchers and advanced university students or postgraduate students, as well as with intermediate level researchers, has very high costs in terms

of the quality of results and scientific productivity. These loses become very difficult to overcome once the exodus of key people occurs, thus cutting "schools" that constitute valuable traditions of scientific and technological research.

The studies on "brain drain" clearly show that when emigration increases, the return of those who are abroad decreases and vice versa. This is easily understandable if we taken into account that both the increase of the emigration flow and the decrease of the return flow are affected by the same causes.

In terms of scientific and technological policies, and in periods of crisis and uncertainty such as the current one, the most intelligent course of action would be, at least, to try to retain in the country the human capital that in some way it has been possible to train throughout approximately one hundred years of investment in education, science and technology, and that society is going to need if it engages at any time in an intelligent strategy of national development that goes beyond the reductive application of any macro-economic model recommended by the creditor banks, within the framework of the ideas of the market fundamentalism.

As of the first moment of the democratic period (1983) begins an awareness of the importance, not only of preventing "brain drain" and accomplishing a return migration, but also of taking advantage of the community of science and technology researchers living abroad, many of whom work in first line academic or scientific institution and have reached levels of excellence. To this respect, only some first steps were taken, but if at any time a coherent scientific and technological policy were to be formulated, which will have available the indispensable minimum resources and management capacity, it would be necessary to think about the performance of a group of actions intended to achieve the possible use of this potential which can be accessed, by the way, at a relatively low cost. The use of the capacity of researchers who are abroad requires special supplementary policies and instruments properly linked to the rest of the national scientific policy.

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ANNEX

Table 1. Distribution of post-graduates by science and jurisdiction, 1979

	Total	**Federal Capital**	**Buenos Aires**	**Córdoba**	**Santa Fe**	**Tuc.**	**All others**	**Post-grad. Gra-duate %**
Total	1,345	864	255	47	4	16	159	2.79
Medical Sciences	177	145	2	24	-	6	-	2.92
Agricultural Sc.	399	192	175	-	-	-	32	18.09
Architecture	2	-	-	2	-	-	-	0.12
Engineering	17	12	-	0	-	5	-	0.48
Exact Sciences	84	6	22	2	-	3	51	5.19
Biochemistry and Pharmacology	315	307	4	-	2	2	-	17.70
Social Sciences	143	110	1	17	-	-	15	0.97
Educational Sc.	22	3	11	-	-	-	8	2.37
Law	104	73	27	-	2	-	2	1.24
Humanities	82	16	13	2	-	-	51	1.14

Source: Data from the Ministry of Education, Graduates Higher University Education, 1979

Table 2. Distribution of post-graduates by category and groups of scientific discipline (%)

	Ph.D.	**Masters**	**Specialization**	**Total**
Agricultural & Veterinary Sc.	2.1	4.8	1.4	2.0
Engineering & Architecture Sc.	8.5	23.8	22.4	15.2
Exact and Natural Sc.	27.1	14.3	4.1	16.8
Medical Sciences	10.1	-	44.2	23.6
Social Sciences	43.1	52.3	27.9	37.4
Humanistic and Moral Sc.	9.1	4.8	-	5.0
Total	100.0	100.0	100.0	100.0

Source: Ministry of Education and Justice, “Universidades Argentinas : Guía de Carreras (1985-86)”

Table : 3 Distribution of post-graduates by scientific discipline and type of University (percentage)

	Agric. & Veter. Sc.	**Eng. & Arch. Sc.**	**Exact and Nat. Sc.**	**Medical Sciences**	**Social Sciences**	**Human & Moral Sc.**
National Universities	71.4	67.3	79.3	85.7	22.5	50.0
Private Universities	28.6	32.7	20.7	14.3	77.5	50.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Ministry of Education and Justice, “Universidades Argentinas : Guía de Carreras (1985-86)”

[1] In the article of Rodriguez, A. (1985), (pseudonym of Oteiza, E.).

[2] Dedijer, S. (1971).

[3] Ianni, O. (1995).

[4] Houssay, B. (1993); Oteiza, E. (1968); Oteiza, E. (1975), Oszlak, O. and Caputo, D. (1973); Sito, N. and Stuhlman, L. (1968) ; Slemenson, M., and others (1970); Torrado, S. (1980).

Drenaje de cerebros
Marco histórico y conceptual

Enrique Oteiza

Introducción

Esta denominación se refiere a la migración internacional cuantitativamente numerosa de personas con alta calificación educacional y proviene del inglés (brain drain), del cual ha sido traducido a diversas lenguas. Por « cerebros » o talentos se entiende en el contexto de esta denominación, a las personas que poseen altas calificaciones intelectuales, tales como científicos de las ciencias sociales o naturales, universitarios graduados en humanidades, profesionales del nivel universitario y otros creadores de similar nivel. La noción puede identificarse en buena medida con la de « intelectuales », aunque se la ha empleado con más frecuencia en relación con un universo algo más restringido, el de científicos y tecnólogos, especialmente los que se dedican a la investigación y en general a la creación de conocimientos avanzados en sus respectivas áreas [1]. Los diccionarios y enciclopedias especializados en ciencias sociales, como por ejemplo la « International Encyclopedia of Social Sciences », dirigida por David Sills, editada por The MacMillan Company & The Free Press en Nueva York, o « A Dictionary of the Social Sciences », dirigido por Julius Gould y William L. Kolb, también editado por The Free Press, no hacen referencia a este concepto bajo la denominación de brain drain ni bajo ninguna otra. Esta falta de inclusión de una denominación que se refiere a un concepto importante en el estudio de los procesos migratorios internacionales, analizado por numerosos autores de diversas disciplinas, constituye sin duda una curiosa omisión. Ya en 1976 Stevan Dedijer publicó una importante bibliografía titulada « Brain Drain and Brain Gain, a Bibliography on the Migration of Scientists, Engineers, Doctors and Students », Programa de Política de Investigación, Universidad de Lund, Suecia.

La masividad y continuidad que este fenómeno migratorio ha adquirido, es el resultado de un intenso aprovechamiento que los países industrial y científicamente avanzados realizan de los recursos humanos altamente calificados, cuya formación implica una inversión de no menos de 20 años de escolaridad (cuando se trata de investigadores en CyT), lo cual insume una fuerte inversión social e individual, así como largos períodos de gestación.

Antecedentes históricos

Para entender la naturaleza específica de este tipo de migración selectiva llamada drenaje de cerebros, y comprender sus diferencias con fenómenos migratorios anteriores, resulta útil repasar aunque sea brevemente algunos de dichos fenómenos, interesantes por la importancia que revistieron en su época.

En la historia de la ciencia y la universidad (por ejemplo en los conocidos textos : G. Sarton, A History of Science, Oxford University Press, 1953; C. A. Parsons, The Alexandrian Library,

Elsevier, Amsterdan, 1952; F. H. Powicke, A. B. Emden, Rashdall's Medieval Universities, Clavendon Press, Oxford, 1936; H. Waddell, The Wandering Scholars, Constable and Co., Londres, 1927), sobresalen dos aspectos importantes de las migraciones de científicos e intelectuales destacados. El primero se refiere a la alta movilidad de las personas con calificaciones intelectuales elevadas, en relación a otros grupos de sus respectivas sociedades de origen; y el segundo lo constituye el papel que las políticas explícitas de atracción han desempeñado en estos movimientos.

Para mencionar sólo algunos ejemplos conviene recordar que Atenas se convirtió en foco de atracción para sabios y filósofos en forma creciente a partir de la fundación por Platón de la Academia, en 388 AC, y posteriormente por iniciativa de Aristóteles, del Liceo, en 335 AC, dentro de un contexto político cultural favorable a ese tipo de actividades innovadoras del pensamiento.

Alrededor del 300 AC, el centro de atracción de científicos migrantes se trasladó a Alejandría como resultado de la política enérgica desplegada por los primeros reyes de la dinastía ptolomeica y mantenida luego por los gobernantes egipcios durante cientos de años [2]. Los medios de vida ofrecidos a los numerosos científicos atraídos a este centro de estudio e investigación, y las posibilidades de trabajo construidas en torno a la Biblioteca y al Museo, constituyeron condiciones únicas en el mundo de esa época para las tareas de investigación y creación intelectual.

En otro período histórico, en Europa, a partir del siglo IX, el surgimiento de la Universidad de Bolonia -la primera- y luego las de París, Salamanca, Oxford y Cracovia, producen importantes migraciones de estudiantes y profesores atraídos desde todos los rincones del Continente hacia esos centros de estudio e investigación. Las secesiones, conflictos diversos y crisis políticas y religiosas, produjeron importantes migraciones de profesores entre las universidades europeas que se fueron multiplicando a lo largo de ese período, fundándose así nuevas casas de estudio por iniciativa de grupos disidentes que solían ser expulsados de las preexistentes, con el apoyo de autoridades locales interesadas en beneficiarse de estos `sabios'inmigrantes.

Cabe destacar que a diferencia del actual fenómeno de drenaje de cerebros, que ha permitido a algunos países incorporar inmigrantes altamente calificados en cantidades que se cuentan por los cientos de miles, en el lapso de las últimas cinco o seis décadas, los procesos migratorios anteriores a los que nos hemos referido involucraban, en el mejor de los casos, sólo a unos pocos cientos de personalidades destacadas del mundo intelectual de la época. También es significativa la diferencia en lo que hace al grado de vinculación entre la generación de nuevos conocimientos y su aplicación a las actividades económicas. Las migraciones calificadas actuales que se dirigen a los países industrialmente avanzados, se insertan en procesos de investigación crecientemente articulados con las actividades de producción de bienes y servicios, lo que no ocurría en siglos anteriores a los dos últimos.

En cuanto a los países centrales, cabe recordar que a partir del Renacimiento se producen profundas transformaciones en la vida urbana y rural de Europa, acompañadas de cambios poco pacíficos de las estructuras políticas y sociales del Continente. Estas transformaciones y dislocamientos marcan fuertemente la naturaleza de las migraciones internacionales de la época.

Este amplio y complejo proceso de cambio a escala europea acompañado de la construcción de nuevos imperios de vastas dimensiones y la extensión luego de estos cambios a los EEUU y otras partes del mundo, produjo diversos tipos de migraciones masivas intercontinentales. Las más relevantes para América Latina fueron las que acompañaron la conquista española y portuguesa, luego el tráfico de esclavos en los siglos XV, XVI y XVII y más tarde la emigración europea masiva ocurrida durante los siglos XVIII y XIX.

El tráfico de esclavos fue un proceso de migración transatlántica forzosa, iniciado por las potencias europeas coloniales, resultando en una emigración africana a América estimada en algo más de 15.000.000 de personas llegados a este continente entre comienzos de 1600 y 1830.

En cuanto a las migraciones europeas durante el siglo pasado y los primeros treinta años del presente se estima que partieron de Europa en ese período unos 60.000.000 de personas, las

que en su gran mayoría se dirigieron a América (Norte, Centro y Sur), y en menor medida a Oceanía y otros continentes (Carr-Saunders, Alexander M., World Population : Past Growth and Present Trends, Oxford, Clarendon Press, 1936). Este fenómeno migratorio intercontinental fue pues de una dimensión inédita, no mantenida a un ritmo similar después de 1930. No sólo el aumento de la tasa de crecimiento de la población europea y las transformaciones sociales profundas ocurridas en ese continente fueron las únicas causas de este éxodo masivo ; las inversiones de capital acumulado en el norte de Europa, dirigidas hacia América y otras partes del mundo y la transferencia de conocimiento tecnológico, constituyeron factores adicionales importantes en el proceso de transplante poblacional, proveniente también de Europa, pero de las zonas marginalizadas en el proceso de « modernización », o expulsadas por guerras, dictaduras y otras formas de persecución religiosa, política e ideológica. El carácter masivo de esta migración naturalmente resultó en el traslado de una cantidad de personas altamente calificadas -universitarios, artistas, etc.- presumiblemente en proporción no mayor que la de su participación en la población económicamente activa existente en Europa, en ese período.

Nuevamente en los dos casos mencionados se observan diferencias importantes respecto al fenómeno migratorio llamado drenaje de cerebros. En el caso del comercio de esclavos se trata precisamente de una migración selectiva, inversa a la actual de altas calificaciones educacionales. La esclavitud consistió en el reclutamiento por la fuerza de trabajadores manuales de poca o ninguna calificación « escolar » en términos europeos, para la realización de trabajo forzado. En lo que se refiere a las migraciones internacionales de origen europeo del siglo pasado y comienzos del presente, se trató a diferencia del drenaje de cerebros, de un proceso masivo, no selectivo, respecto a las calificaciones de los migrantes.

Las migraciones selectivas

Europa industrializada y más tarde los Estados Unidos difunden y expanden su economía, en un proceso de dominación hegemónica, a través de los imperios coloniales y neo coloniales establecidos por diversas metrópolis y, posteriormente, de manera creciente mediante el dominio del sistema financiero y la construcción de monopolios tecnológicos operados fundamentalmente por las llamadas « empresas multinacionales », hasta alcanzar las características bien conocidas de la fase actual de la globalización -con un centro (Norte) de países industrial y científicamente avanzados y una periferia (Sur) de países semi, poco o nada industrializados - éstos últimos con desarrollo científico muy limitado, en el mejor de los casos-. En esta fase del largo proceso histórico de globalización, se observan tendencias contradictorias hacia la regionalización con integración de naciones por un lado, y desintegración nacional, por el otro [3]. La dinámica incluye brechas sociales crecientes entre el Norte y el Sur, así como al interior de casi todos los países del mundo.

Es a partir de la Primera Guerra Mundial que los países de origen y de destino de los principales flujos migratorios internacionales, comienzan a definir y aplicar en mayor grado, políticas tendientes a retener o atraer personas con determinadas calificaciones de acuerdo a sus intereses respectivos.

La crisis mundial de 1930 produjo un cierre relativo de la inmigración por parte de varios países que hasta entonces habían sido los principales receptores, no obstante lo cual la situación política y económica de Europa continuó impulsando el éxodo.

Pero sólo después de la Segunda Guerra Mundial la selectividad de las migraciones internacionales se amplía y se perfecciona, produciendo un verdadero drenaje de personas altamente calificadas desde países menos desarrollados a otros industrial y científicamente más avanzados.

Caracterización del « drenaje de cerebros »

El tipo de migración al que se refiere este trabajo constituye entonces el traslado de un país a otro, o a varios otros países, de cantidades significativas de personas que poseen un alto grado de capacitación obtenido casi siempre a partir de los sistemas de educación formal del país de origen de la corriente migratoria. En general, se incluye en la definición de este tipo de migración selectiva a las personas que han obtenido por lo menos el primer grado universitario en el país de origen. Los artistas en su calidad de tales pueden ser incluidos en la migración de recursos humanos de alto nivel, aún cuando no hayan alcanzado este primer grado universitario. En algunos países donde las asociaciones profesionales cumplen un papel de acreditación importante se podrían incluir también a ciertas personas que no fueran artistas ni poseyeran grado universitario, siempre que éstas hubieran sido admitidas por dichas asociaciones.

El « drenaje de cerebros » tiene características distintivas que aparecen en plenitud como un fenómeno de la post Segunda Guerra Mundial. Tiene su origen en una toma de conciencia clara por parte de gobiernos de países centrales (primero USA y más tarde Europa Occidental), del valor incorporado en los recursos humanos de alto nivel de educación formal y capacitación en determinadas especialidades, para asegurar el desarrollo económico, social y cultural. La importancia que se le asigna a la investigación en ciencia y tecnología en los países industrialmente avanzados (aprox. en dichos países se invierte el 2 % del PBI en investigación CyT), actividad de gran intensidad en la utilización de recursos humanos de alto nivel, estimula considerablemente la demanda de personas altamente capacitadas.

Hasta hace unos años algunos países avanzados de la OCDE realizaban proyecciones de la estructura ocupacional con una perspectiva de diez a quince años, con el objeto de estimar la cantidad de personas en la población económicamente activa que se requerirían con diferentes tipos de especialización y nivel de educación formal, con el fin de orientar la estrategia educativa y satisfacer así diversos objetivos nacionales. De esta manera dichos países determinaban lo que actualmente se conoce como la demanda futura de recursos humanos necesarios para un cierto tipo de desarrollo nacional.

Estados Unidos, Canadá, Australia, y la mayor parte de los países de Europa Occidental, emplearon y emplean este tipo de análisis para definir de este modo sus políticas inmigratorias selectivas. Actualmente, la crisis de empleo y la incertidumbre respecto a las perspectivas de crecimiento económico, han contribuido a reducir el optimismo respecto a la utilidad de este tipo de ejercicios, aunque sí se mantienen las políticas inmigratorias selectivas y aumentan diversas formas de discriminación respecto a la movilidad de las personas a nivel internacional cuando esto conlleva un cambio en cuanto a país de residencia.

Al definir los países centrales las políticas arriba mencionadas, se desarrolló una corriente migratoria de recursos humanos de alto nivel entre dichos países y algunos de los países subdesarrollados con disponibilidad de personas entrenadas a buen nivel en las especialidades requeridas por los primeros. Estas corrientes se mueven en muchas direcciones y entre pares de países, pero según los datos empíricos disponibles, se confirma que el flujo neto entre dos países se dirige de los menos desarrollados a los más desarrollados, y que el patrón de flujos migratorios internacionales es definido y relativamente estable. Tiene un trasfondo estructural e involucra a un conjunto bien definido de países. Observando, pues, los datos empíricos sobre flujos migratorios netos de recursos humanos de alto nivel, es posible identificar cuatro grupos de países según su posición con respecto a este tipo de migración. Para cada uno de estos cuatro grupos se tomarán uno o más países a efectos ilustrativos :

a) Por ejemplo : Estados Unidos. Muy importante entrada de inmigrantes altamente capacitados. Insignificante salida de emigrantes igualmente capacitados que dejan los Estados Unidos.

Desde el punto de vista del « drenaje de cerebros », Estados Unidos puede ser considerado como estación terminal. Este país es gran importador neto de recursos humanos de alto nivel.

b) Por ejemplo : Inglaterra y Canadá. Considerable entrada de inmigrantes con alta capacitación que provienen de países menos desarrollados, ex-colonias y otros países del Este de Europa y del Sur. Considerable salida de emigrantes igualmente capacitados que dejan esos países para dirigirse a EEUU y en el caso de Inglaterra, también a Australia, Nueva Zelandia y otros países europeos. Desde el punto de vista del « drenaje de cerebros », los países en esta situación pueden ser considerados en un sentido amplio del término como estaciones de tránsito, pues tienen un saldo neto que fluctúa llegando a ser a veces exportadores y otras importadores netos de recursos humanos de alto nivel.

c) Por ejemplo : Argentina (países relativamente menos industrializados). Escasa entrada de inmigrantes altamente capacitados e importante salida de emigrantes calificados, los que se dirigen en su mayoría a EEUU, a algunos países europeos y a Israel. Este tipo de países son exportadores netos de recursos humanos de alto nivel.

d) Por ejemplo : India (países subdesarrollados). Insignificante entrada de inmigrantes con alto nivel de educación e importante salida de emigrantes de las mismas características, en su mayor parte hacia Inglaterra, Canadá, EEUU y el resto de Europa Occidental. Un país de este tipo es exportador neto de capital humano en mayor medida aún que los países anteriores.

La existencia de sistemas inmigratorios selectivos en países altamente industrializados en un mundo donde hay grandes disparidades en el grado de desarrollo económico y científico entre estos países y los subdesarrollados, genera migraciones importantes de recursos humanos con alto nivel de capacitación. Estos sistemas de emigración selectiva permiten a los países más avanzados resolver sus déficits de fuerza de trabajo altamente calificada, en el corto y mediano plazo, en categorías ocupacionales en las que el número de graduados universitarios de diversas especialidades se prevé será insuficiente ; éste es, por supuesto, uno sólo de los aspectos del problema. A largo plazo, los flujos en las diferentes especialidades producidos por el sistema de educación, pueden ajustarse mediante medidas de planeamiento o de expansión educacional encaradas internamente por los gobiernos para llenar los vacíos cubiertos temporariamente por la emigración selectiva. En un sistema de emigración de este tipo las visas permanentes o de residencia, que son las que permiten el ingreso a la fuerza del trabajo del país de destino del migrante, se acuerdan según los criterios de escasez de mano de obra altamente calificada determinados más arriba, o por solicitud directa de instituciones universitarias, de investigación, o empresas ; su asignación por parte del estado constituye el mecanismo a través del cual se controla la selectividad.

Por supuesto, la escasez o la abundancia de oferta de un tipo determinado de recursos humanos de alto nivel, es un concepto que puede ser o ha sido interpretado de diferentes maneras. Sin embargo, el método que considera los requerimientos de recursos humanos en relación con los objetivos nacionales parece ser, hasta ahora, el principio rector en la determinación de las políticas de inmigración selectiva, año tras año. Las políticas inmigratorias siguen revistiendo características nacionales aún dentro de procesos de regionalización en marcha.

Una característica importante del migrante con alto nivel educacional, como se vio anteriormente, es su movilidad. Quien ha llevado a cabo estudios universitarios, especialmente si los ha efectuado en el país periférico de origen en una institución de buena calidad educacional, de acuerdo a los patrones de medida de los países « desarrollados », conoce por lo menos una lengua extranjera, normalmente uno de los idiomas de los países industrialmente avanzados. Esta clase de persona altamente capacitada lee también regularmente las publicaciones técnicas extranjeras más relevantes en su especialidad, participa en encuentros internacionales y sabe cuales son los lugares clave en cuanto al desarrollo de su campo de trabajo. Los contactos con lo que económicamente se puede considerar un mercado internacional imperfecto del factor

trabajo, se facilitan en este caso por el abaratamiento relativo del transporte, lo que a su vez facilita la emigración eventual. La movilidad y la información parecen ser mayores en campos tales como los de la ciencia, la ingeniería y la medicina, en los que la demanda por parte de las naciones industrialmente avanzadas ha sido muy fuerte en las últimas décadas.

En los cuadros 1 y 2 Brinley Thomas (El Drenaje del Talento, pag. 75 y 81, Editorial Paidós, Buenos Aires, 1971) ilustra ya para entonces, sobre la magnitud de las migraciones selectivas a algunos de los principales países receptores. Estos datos son significativos del impacto de la instauración del sistema de inmigración selectiva, por parte de países del Norte.
Comparando en el cuadro 1 la selectividad de la emigración de tres importantes países receptores, EEUU, Canadá y Australia, se observa que para el primero de éstos, durante el período 1947 a 1965, la ventaja en la proporción de inmigración bruta de personal profesional y técnico, lo que refleja una mayor capacidad relativa de selectividad por parte del país receptor en cuanto a calificaciones. Con respecto a la comparación de las cifras de emigración de personal profesional y técnico, la diferencia con los EEUU aumenta considerablemente si se tiene en cuenta que Canadá sufre un importante flujo de emigración de personas altamente calificadas hacia los EEUU (ver estadísticas migratorias, Canadian Labour Departament).

El cuadro 2 es ilustrativo sobre todo en lo que se refiere a la magnitud relativa de la contribución efectuada por diversos países y regiones de origen de los inmigrantes altamente calificados, que en términos de números de personas ingresaron a los EEUU. Los años 1962-1964 son

Cuadro 1. Magnitud relativa de las corrientes de inmigrantes profesionales en los mayores países receptores (para el período en que se consolida y perfecciona -hacia el final- la selectividad en dichos países)

	EE.UU. 1947-1965	**Canadá 1946-1965**	**Australia 1949-1966**
Total de trabajadores inmigrantes	2 208,405	1 314,878	1 098,567
Personal profesional y técnico	372,204	145,501	90,438
Porcentaje de profesionales y técnicos sobre el total de trabajadores emigrantes	16.9 %	11.1 %	8.2 %
Porcentaje de profesionales y técnicos sobre el total de de trabajadores emigrantes en 1965	22.0 %	22.4 %	9.5 %

Nota : la clasificación « Personal profesional y técnico » no es exactamente comparable para los tres países.
Fuentes : Informes anuales del Servicio de Inmigración y Naturalización, Departamento de Justicia, Washington D.C., EE. UU.
Informes anuales del Departamento de Ciudadanía e Inmigración, Ottawa, Canadá.
Australian Inmigration : Consolidated Statistics, Canberra, 1966.

Cuadro 2. Científicos e Ingenieros admitidos en EE.UU. como inmigrantes según países o regiones de nacimiento, 1962-1964*

Pais o region	1962		1963		1964	
	Número	%	Número	%	Número	%
Europa	2,431	56.6	3,002	50.6	2,982	51.8
Alemania	356	8.3	428	7.2	491	8.5
G. Bretaña e Irlanda del Norte	925	21.5	1,153	19.4	1,175	20.4
Canadá	526	12.2	633	10.7	685	11.9
Cuba	289	6.7	198	3.3	236	4.1
México	58	1.4	61	1.0	55	0.9
América del Sur	219	5.1	327	5.5	426	7.4
Asia	498	11.6	1,406	23.7	1,053	18.3
Otros orígenes	276	6.4	306	5.2	325	5.6
Todos los países	4,297	100.0	5,933	100.0	5,762	100.0

* Este cuadro incluye los científicos sociales: 192 en 1962, 231 en 1963 y 283 en 1964.
Fuente: Scientists and Engineers from Abroad, 1962-64, NSF 67-3 (Washington, D.C.: National Science Foundation, 1967), p. 5.

ilustrativos también del perfeccionamiento de la política de selectividad inmigratoria, pues toman los períodos inmediatamente anterior y posterior a la aplicación de la nueva ley de inmigración de los EEUU sancionada en 1962.

En el cuadro 2 aparece con claridad como a mediados de los 60, sobre todo a partir de esta nueva ley, los países subdesarrollados más pobres como los del Asia, pasan a incrementar su aporte migratorio calificado.

Algunas cuestiones fundamentales en torno al « drenaje de cerebros »

Los análisis economicistas neoclásicos del problema del éxodo de cerebros, como por ejemplo los de Harry Jonson, parten de premisas tradicionales de la teoría de la economía internacional, construyendo modelos conceptuales -formales- en los que se supone que la libre movilidad de los factores de producción y productos entre las economías mundiales, en función de la maximización de los beneficios de las firmas y las personas-económicamente medidos-, resulta en el mayor grado de satisfacción posible de una función de bienestar a escala mundial (se toma en cuenta básicamente sólo el aumento de la maximización del producto, sin tomar en cuenta si los beneficios fluyen o no, si se distribuyen bien o mal, si el conocimiento generado es de libre circulación o está monopolizado de hecho o de derecho). Por lo tanto, en lo que se refiere a personas altamente calificadas, los autores de esta orientación propician el mantenimiento de la movilidad actual -como si esta fuera libre- en planteos de tipo « internacionalista ».

La falacia principal de este tipo de razonamiento consiste en que en el mundo de las últimas décadas y en el actual, no existe libre movilidad de los factores de producción (no existen las migraciones libres de los individuos sino las selectivas operadas por unos pocos estados receptores), ni existe libre circulación de la tecnología. Tampoco existe ningún tipo de mecanismo aceptable de distribución o redistribución de los beneficios producidos por la economía mundial, ya que a través de prácticas monopólicas diversas y manejos hegemónicos basados en varias formas de concentración de poder, los países avanzados se apropian de una proporción muy alta de la riqueza mundial. Estos mecanismos de concentración de diversas formas de poder : económico ; militar ; tecnológico ; etc., han llevado en el plano internacional a una situación donde las brechas existentes entre los países subdesarrollados y los avanzados, no ha hecho sino aumentar desde la Segunda Guerra Mundial -en la última década y media también aumenta la brecha social al interior de los países del Norte-.

Es precisamente dentro de esta red de flujos internacionales de factores, bienes y servicios y de la manera como esta red se ha ido configurando a partir de la revolución industrial, que debe enmarcarse el análisis y la interpretación del fenómeno del éxodo de cerebros. El llamado intercambio desigual entre el `centro'y la `periferia'está, por naturaleza, firmemente anclado en las características de la estructura económica internacional que desde los países industrialmente avanzados articula a los semindustrializados y los netamente subdesarrollados. El éxodo de cerebros ha contribuido de manera concreta y no insignificante a la expansión y consolidación de la capacidad creativa en el campo de la ciencia y la tecnología de los países centrales, y dentro de ellos muy especialmente de los Estados Unidos. Dada la organización científica y económica de estos países, donde el conocimiento que se genera es velozmente incorporado a la maquinaria productiva y teniendo en cuenta su poder mundial, la tecnología que se genera en el `centro'con ayuda de la de los científicos y tecnólogos inmigrantes, realimenta una red de intercambios asimétricos que, a su vez, aumenta continuamente las diferencias entre países

ricos y países pobres. Los conocimientos transformados en tecnología permiten a las grandes corporaciones de los Estados Unidos, Europa y Japón, constituir monopolios y ventajas tecnológicas explotadas luego multinacionalmente en beneficio principalmente de grupos sociales privilegiados, mucho más numerosos en las sociedades nacionales centrales.

Los enfoques de tipo `nacional' son una comprensible reacción a la trampa que en esta materia implica, para los países subdesarrollados, el internacionalismo ingenuo, aunque por otros motivos puede llevar también a análisis equivocados del fenómeno de las migraciones selectivas. Es obvio que problemas de dimensiones cuasi mundial, determinados en gran medida por los países centrales, no pueden ser analizados correctamente sólo dentro de los límites de la dimensión nacional de un país periférico origen de una migración determinada.

En cuanto al mecanismo que desencadena la decisión de emigrar que realiza el migrante, sus dimensiones son múltiples, por lo que éstos no pueden ser comprendidos a través de un enfoque puramente económico. La decisión de emigrar no se realiza en abstracto, ni consiste simplemente en la decisión de abandonar un país determinado, sino que surge de una comparación concreta de la percepción que tiene de su situación el migrante potencial en su país de origen, y la comparación que él efectúa con su percepción de las perspectivas que se le presentan en otro país, el de destino.

La situación migratoria está en medida importante estructuralmente definida en el plano internacional, pero la decisión de quien emigra implica el acto de efectuar una comparación entre las percepciones que el migrante tiene de dos situaciones, la presente en el país A y la futura en el país B. Para el análisis de la dimensión motivacional psico-social de las migraciones, el enfoque a través de diferenciales de factores que se comparan a través de los países de origen y destino es más adecuado que el análisis desintegrado tipo `empuje'(push) y `atracción'(pull) que se emplea en muchos estudios.

Los factores más relevantes a comparar dentro de un análisis de diferenciales entre el país de origen y el de destino, son los siguientes : diferencia de ingreso real ; diferencia entre medios de trabajo (apoyo logístico) ; diferencia de reconocimiento social a la especialidad de la que se trate ; diferencias en lo que respecta a variables sociopolíticas tales como respeto a la posición político-ideológica del migrante, posibilidad de disenso político, represión, libertad académica, etc. En este nivel de análisis también aparecen las características estructurales del sistema mundial como las que determinan en buena medida las diferencias entre los factores mencionados. Por lo tanto el diferencial comparativo que motivacionalmente moviliza las decisiones de migrar es el desencadenante de la oferta migratoria de donde los países avanzados seleccionan los inmigrantes calificados en la cantidad y calidad necesaria mediante un sistema selectivo racional (pasa/no pasa), operado por los países receptores.

Existe, sin embargo, un margen de maniobra para los países subdesarrollados y aún mayor para los semindustrializados, para paliar este tipo de éxodo costoso. En primer lugar no puede ignorarse que en estos países se producen a veces procesos de persecución ideológica y política extrema, tanto de tipo interno como inducidos de afuera (por ejemplo la represión aplicada en América Latina a través de la Doctrina Hemisférica de Seguridad Nacional durante varias décadas) en parte como resultado hasta 1989 de la guerra fría, que favorecieran la emigración de personas calificadas y en algunos casos produjeron una real expulsión.

En segundo término y más corrientemente, el modo de desarrollo con industrialización dependiente, común en los países subdesarrollados, no genera demanda efectiva de nuevos conocimientos que podría producir la investigación científico-tecnológica local, por lo que está se desenvuelve en pequeña escala y sin anclaje social real.

En tercer lugar los sistemas educacionales de los países subdesarrollados son imitativos en una medida importante en cuanto a los curriculum, contenidos, orientaciones y textos, por lo que sus egresados muchas veces están mejor preparados para trabajar y encarar los problemas de las sociedades centrales que los de sus propios países de origen.

Como comentario final puede afirmarse que el drenaje de cerebros es un fenómeno migratorio negativo para América Latina y en general para los países y regiones de menor desarrollo. No sólo estos países pierden la inversión económica y social que han efectuado para entrenar a quienes luego se van para realizar su aporte social y económico en los países del centro, sino que además este tipo de migración selectiva refuerza las estructuras que expanden y perpetúan las diversas formas de intercambio desigual, lo que lleva a ahondar aún más las diferencias entre los países pobres y ricos.

Balance de la emigración de investigadores en ciencia y tecnología en la Argentina

El efecto combinado de la falta de una política coherente de recursos humanos para el Complejo Científico y Tecnológico, en un marco de inestabilidad política y económica, regímenes militares antidemocráticos y represivos, intervenciones y debilitamiento universitario y falta de valoración del talento nacional por parte de los sectores productivos, se manifestó en el caso argentino en un costoso fenómeno de emigración de investigadores altamente calificados [4].

Así, el brain drain no sólo afectó en la Argentina al Complejo de actividades de investigación científica y tecnológica, sino en general a la posibilidad de acumular capacidad creativa en la sociedad toda, lo cual supone naturalmente, para quienes detentan el poder, aceptar y valorar la existencia posible de un pensamiento crítico.

El fenómeno de emigración selectiva comenzó a llamar la atención de personas interesadas en el desarrollo científico y tecnológico nacional y de estudiosos de los problemas migratorios en nuestro medio, ya a principios de la década del 60. Así fue posible observar desde nuestra realidad que a partir de la Segunda Guerra Mundial, los países industrializados del Norte comenzaban a aplicar políticas migratorias selectivas de manera sistemática, con el fin de atraer personal científico y técnico altamente calificado, recursos humanos que dichos países consideran estratégicos para sus desarrollos. A lo largo de más de tres décadas, nuestro país siguió el camino inverso, produciendo un fuerte éxodo de investigadores, debido al efecto perverso de los factores que ya hemos mencionado.

Este cuadro desfavorable tuvo lugar en un contexto de falta de interés y demanda laboral en investigación Científica y Tecnológica por parte de las elites políticas dominantes y de los sectores productivos de bienes y servicios, de un bajo reconocimiento social de investigadores y profesores universitarios y de una política de bajas remuneraciones a científicos y tecnólogos.

Estas circunstancias negativas han producido la situación excepcional para un país en desarrollo de nivel intermedio, como es la Argentina, de tener aproximadamente 150.000 graduados universitarios en el exterior, en una población expatriada que puede estimarse entre los 800.000 y un millón de personas. Tomando en cuenta la selectividad en el otorgamiento de visas de inmigrante que aplican la mayor parte de los países receptores de nuestro éxodo, y los datos que surgen de los estudios realizados, se puede estimar que existen entre 30 y 50.000 científicos y técnicos argentinos de nivel universitario en el exterior, algunos de ellos con calificaciones sobresalientes. La magnitud de esta pérdida puede medirse rápidamente si se tiene en cuenta que los investigadores activos en la Argentina son menos de 15.000, si se incluyen en esta estimación a quienes teóricamente se desempeñan con dedicación exclusiva a sus tareas científicas y tecnológicas, ya sea como investigadores o como docentes investigadores, y que en el momento actual se están llevando a cabo reformas en el Sector de Investigación Científico-Tecnológico que resultarían en un achicamiento de las capacidades preexistentes (como resultado del asesoramiento y de las presiones del Banco Mundial).

Por otra parte, si se aplican las cifras más bajas que estiman los países desarrollados como el costo social de producir un investigador en ciencia o tecnología que recién comienza su carrera, resulta que aún suponiendo que hubiera en el exterior 30.000 investigadores, el país habría perdido como inversión educacional un mínimo de 1.500.000 millones de dólares (sin tomar en cuenta el costo de la formación de investigadores posterior al egreso de la universidad, ni el de los egresados universitarios en otras especialidades no incluidos en esta estimación).

Desde luego, tanto en términos de tiempo como inversión, el costo de perder líderes de buenas « escuelas » científicas o tecnológicas, en una especialidad determinada, es mucho más elevado. De la misma manera, la ruptura de las cadenas generacionales entre los investigadores senior y estudiantes universitarios avanzados o los de postgrado, así como con los investigadores de niveles intermedios, tiene costos muy elevados en términos de la calidad de los resultados y de la productividad científica. Estas pérdidas resultan muy difíciles de remontar una vez que se produce el éxodo de personas clave, cortando así « escuelas » que constituyen valiosas tradiciones de investigación científica y tecnológica.

Los estudios sobre « fuga de talentos » muestran claramente que cuando la emigración aumenta, el retorno de quienes están afuera disminuye, y viceversa. Esto es fácilmente comprensible si se tiene en cuenta que tanto el aumento del flujo emigratorio como la disminución del flujo de retorno están afectados por las mismas causas.

En términos de política científica y tecnológica, y en períodos de crisis e incertidumbre como el actual, lo más inteligente sería, por lo menos, tratar de preservar en el país el capital humano que de alguna manera se ha logrado formar a lo largo de aproximadamente cien años de inversión en educación, ciencia y tecnología, y que la sociedad va a necesitar si se lanza en algún momento a una estrategia inteligente de desarrollo nacional que vaya más allá de la aplicación reduccionista de algún modelo macroeconómico recomendado por la banca acreedora, en el marco de las ideas del fundamentalismo de mercado.

A partir del primer momento del período democrático (1983) comenzó a tomarse conciencia de la importancia, no sólo de evitar el « drenaje de cerebros » y lograr una migración de retorno, sino también de aprovechar la comunidad de investigadores en ciencia y tecnología radicados en el exterior, muchos de los cuales trabajan en instituciones académicas o científicas de primera línea y han alcanzado niveles de excelencia. En este sentido, se llegaron a dar sólo algunos primeros pasos, pero si en algún momento se formulara una política científica y tecnológica coherente, que contara con los recursos mínimos y la capacidad de gestión indispensables, habría que pensar en el desarrollo de un conjunto de acciones tendientes a lograr el aprovechamiento posible de este potencial accesible, por cierto, a un costo relativamente bajo. El aprovechamiento de la capacidad de los investigadores que están afuera requiere políticas e instrumentos especiales complementarios y bien articulados con el resto de la política científica nacional.

ANEXO

Cuadro 1. Distribución de egresados de posgrado por ciencia y jurisdicción, 1979

	Total	Capital Federal	Buenos Aires	Córdoba	Santa Fe	Tuc.	Resto Egreso G.	Egreso P.G.
Total	1,345	864	255	47	4	16	159	2.79
C. Médica	177	145	2	24	-	6	-	2.92
C. Agro.	399	192	175	-	-	-	32	18.09
Arquitectura	2	-	-	2	-	-	-	0.12
Ingeniería	17	12	-	0	-	5	-	0.48
C. Exactas	84	6	22	2	-	3	51	5.19
Bioq. y Farm	315	307	4	-	2	2	-	17.70
C. Sociales	143	110	1	17	-	-	15	0.97
C. Educación	22	3	11	-	-	-	8	2.37
Derecho	104	73	27	-	2	-	2	1.24
Humanidades	82	16	13	2	-	-	51	1.14

Fuente : Datos del Ministerio de Educación. Egresados Educación superior Universitaria, 1979

Cuadro 2. Distribución de títulos de posgrado por categoría y grupos de disciplina científica (en %)

	Ph.D.	Magisters	Especialization	Total
Agricultura y Veterinarias	2.1	4.8	1.4	2.0
Cs. de la Ing y Arq.	8.5	23.8	22.4	15.2
Cs. Exactas y Naturales	27.1	14.3	4.1	16.8
Cs Médicas	10.1	-	44.2	23.6
Cs. Sociales	43.1	52.3	27.9	37.4
Cs Humanísticas y Morales	9.1	4.8	-	5.0
Total	100.0	100.0	100.0	100.0

Fuente : Ministerio de Educación y Justicia, Universidades Argentinas : Guías de Carreras (1985-86)"

Cuadro 3. Distribución de títulos de posgrado por disciplina científica y tipo de Universidad (en porcentaje)

	C. Agrop. y Veter.	C. Ing. Y Arq.	C. Exac. y naturales	Cs. Médicas	Cs. Sociales	Cs. Human. y Moral
Univ. Nacionales	71.4	67.3	79.3	85.7	22.5	50.0
Univ. Privadas	28.6	32.7	20.7	14.3	77.5	50.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Fuente : Ministerio de Educación y Justicia, Universidades Argentinas : Guía de Carreras (1985-86)

[1] En el artículo de Rodríguez, A. (seudónimo de Oteiza, E.) ; « Los Científicos Sociales Latinoamericanos como nuevo tipo de intelectuales », El Trimestre Económico, Num. 198, 1983, se presenta un resumen de las teorías sobre intelectuales más empleadass

[2] Stevan Dedijer, Primeras Migraciones, pag. 35 del libro El Drenaje de Talento, compilado por Walter Adams, Editorial Paidós, Buenos Aires, 1971.

[3] Ianni, Octavio ; « Teorías de Globalizacao » ; Civilizao Brasileira, Río de Janeiro,

[4] Bernardo Houssay, « La emigración de los científicos y técnicos de la Argentina », en Ciencias Iteramericanas, Washington D.C., julio-agosto 1963. Enrique Oteiza, « Un replanteo teórico de las migraciones de personal altamente calificado », en Walter Adams, The Brain Drain, Nueva York, The McMillan Co., 1968 (Buenos Aires, Paidós, 1971). Enrique Oteiza, « La emigración de ingenieros en la Argentina. Un caso de `brain drain'latinoamericano », Revista Internacional del Trabajo, Ginebra, 1965, v. 72, n° 6. Oscar Oszlak y Dante Caputo, « La emigración de personal médico desde América Latina a los Estados Unidos : hacia una interpretación alternativa ». Documento presentado ante la Conferencia Panamericana sobre Planificación de Recursos Humanos en Salud, Ottawa, Organización Mundial de la Salud, septiembre 1973. Nilda Sito y Luis Stuhlman, « La emigración de científicos de la Argentina », San Carlos de Bariloche, Fundación Bariloche, Departamento de Sociología, 1968. Marta Slemenson y otros, « Emigración de científicos argentinos : organización de un éxodo a América Latina. Historia y consecuencias de una crisis político-universitaria », Buenos Aires, Instituto Torcuato Di Tella, 1970. Susana Torrado, « El éxodo intelectual latinoamericano hacia los Estados Unidos durante el período 1961-1975 », en Migraciones Internacionales de las Américas, CEPAM, Caracas, 1980, v. 1, n° 1.

Migration of Scientists in the History of Science in Totalitarian Societies

Yakov M. Rabkin

Introduction

Throughout this century totalitarian regimes were the most important sources of migration of scientists among industrially developed nations. Three major European countries experienced totalitarian regimes : the Soviet Union, Fascist Italy and Nazi Germany. All three lost scientists in response to a variety of policies adopted by these regimes. Reverse migration was very limited, mostly consisting of a few Soviet-bound Western scientists with a strong commitment to the Communist cause. They rarely lasted beyond the 1930s, either returning to their native lands or falling prey to the Great Terror.

One would expect any government, and a fortiori a government devoted to strengthening the State and to mobilizing the society, to oppose or prevent emigration. Scientists'strategic value had been amply demonstrated in the course of World War I. However, all three of the governments ended up causing emigration, willingly or not. While showing varying degrees of commitment to scientific growth, the leaders of the three countries all shared a strong belief in technological progress.

Soviet Exodus in Stages

The Soviet government was, perhaps, the most committed to science. Positivist sources of Marxism, the adulation of science as the ultimate means of human cognition, the very couching of their societal project in scientistic terms account for this unprecedented commitment.

This made the Communists begin to pay close attention to the welfare of science and to that of scientists from the very first months of the regime. Science was an exclusive domain of the Soviet State. In this sense science appeared to be no different from industry, foreign and internal trade, literature or ballet, all of which came to belong exclusively to the State. Science was, perhaps, distinct from most of these other spheres of human endeavour in that Russia's science had always been a state activity.

The Russian State literally imported Western science from Europe in the early XVIIIth century and has remained its exclusive patron ever since. The State considered science above all as a resource and a symbol. It would enhance Russia's military standing. Moreover, the cultivation of science made a persuasive claim on behalf of Russia that she belonged to " the civilized Europe ". Indeed, Russia's military might, its role in world affairs, its embrace of Christianity, and the presence of a Europeanized cultural stratum - which includes scientific elites - creates the impression that Russia is a modern society, imbued with Western mentality and a commitment to certain basic values. In reality, the bulk of Russia's population remained only partly

affected by occasional bouts of modernization since these would invariably befall Russia from the top, i.e. from its political and intellectual elites operating under varying degrees of government control. Gorbachev's perestroika was initiated and administered from the top, albeit infinitely more gently than Peter's modernization or Stalin's industrialization.

The fate of Russia's science can be compared to that of science in many a Third world country. In both, modern science was introduced in total disregard and, occasionally, in opposition to, autochtonous cultures and modes of cognition. Modern science was an exclusive, intolerant and arrogant culture. The intellectual dominion of the Scientific Method in society, not only in science, was a *sine qua non* condition of the transfer of science to non-Western cultures.

Science is an activity historically linked to Western capitalism and liberal values. The language of the original chapter of the Royal Society of London offers a good example of this link. It is not clear, however, how vital is this link for the development of science. Science suffered a peculiar fate in Russia's collective psyche. Its assimilation by society has been hotly debated ever since Peter the Great imported and imposed science on his domain. Attitudes to science often served a reliable litmus test to tell a " Slavophile ", proponent of a specifically Russian national course of development, from a " Westernizer ", an enthusiastic believer in the transfer of Western cultural, political and economic models.

Yet, it remains to be proven that scientific sophistication and political oppression are indeed incompatible. In 1933 Germany turned totalitarian all the while retaining its frighteningly high level of technological efficiency. In the USSR backwardness and inefficiency palliated rather than accounted for Stalin's terror. Alexander Hertzen, a nineteenth-century Russian dissident *litterateur*, feared that technological progress would bring about a " Genghis Khan with the telegraph ". Indeed, as the 20th century draws to a close it is increasingly difficult to believe in the ennobling qualities of science and technology. However, when totalitarian regimes made their appearance on the historical scene science was perceived as an incontestable sign of not only material, but also of spiritual progress.

It is in this context that the Soviet government faced a massive exodus of Russia's educated population in the course of the Civil War of 1918-1922. Scientists, whose fate was of concern to the new government, took part in the emigration. The atmosphere that characterized the first years after the Bolshevik takeover was thus characterized by a would-be emigre scientist. The years 1919-20 were a period of a growing - from week to week, from month to month - sentiment of moral mortal oppression, unbearable for a normal human, which is even hard to define except for the term " moral asphyxation ". The same author, medical researcher Manukhin, further explains reasons for the emigration :

"Everything is done with lies, in a misleading, hostile, angry way, in a completely, integrally illegal manner. Innumerable decrees fall upon the citizen, but there is no law, and its mere principle is absent. It is little wonder that Russians flee to the borders : to Finland, to the Ukraine, to Poland, to Belorussia. One wanted to live in whatever fashion : in poverty, in misery, as a vagabond, as a stranger but not under the obligation to live against one conscience".

Emigre scientists soon organize in academic associations in various countries. Cohesiveness of emigre scientists was particularly strong in the 1920s, before Stalin's consolidation of power would put an end to most hopes of return to Mother Russia. The first congress of academic associations of " Russian Abroad " is held in 1921. Berlin, formerly a major recognized centre of world science, also became a major centre of emigre Russian science in the 1920s. It is noteworthy that the first foreign scientific mission of the Soviet government was also attached to the Soviet Embassy in Berlin in 1922. Close political links between the two ostracized countries, Soviet Russia and Weimar Germany, facilitated such links. Prague and Belgrade were other important centres of scientific and scholarly activities for Russian emigres. Most considered their emigration temporary, which fostered cohesiveness and solidarity. A two-volume

bibliography of scientific publications by Russians abroad serves as a reminder of the magnitude of this phenomenon.

In the course of Soviet history thousands of Soviet scientists came to work in the West and never returned to the USSR. Several waves of emigration can be identified. The first one, in the years 1918-20, consisted of those who rejected the new Soviet regime and decided to leave Soviet Russia either to fight it from outside or just to wait till the regime would collapse. The first wave included scientists among the educated classes who found Communism unacceptable.

The second wave, in 1922-23, consisted exclusively of intellectuals and was caused by Lenin's decision to exile prominent scholars and scientists who had not overtly embraced the new regime. After the publication of an article " About the meaning of militant materialism ", Lenin instructed the Department of Justice to formulate a legal framework for substituting capital punishment with exile abroad, and for punishing unauthorized return to Russia with death. Arrests and interrogations ensued, with elite, most renowned scholars promptly exiled abroad, while less known, and understandably more numerous, intellectuals exiled to distant provinces of Russia. It is noteworthy that the intellectuals exiled abroad had to pay their own way, a precedent that may have inspired the architects of the " Final solution " in Nazi-dominated Europe to make Jews who were being deported purchase their own rail tickets for the final trip to Poland " for resettlement ". The second wave consisted of scholars and, to a lesser degree, of scientists and engineers. The ambivalence of the regime was well demonstrated in cases when a scientist slotted for exile would be found to be " the only specialist in his field ". High-level intervention on the part of leaders of industrial ministries might reverse or delay a deportation order in the cases of scientists or engineers.

Among the exiles was Pitirim Sorokin, future mentor of Robert Merton, sociologist of science, at Harvard. Sorokin said, prior to his exile, in a speech to students :

"The task of resurrecting Russia falls on your shoulders, it is a task infinitely hard and difficult... The first that you should take along is knowledge, pure science that is obligatory for everyone... But do not take surrogates of science, pseudoknowledge and confusions counterfeited so well to look like real science, be they " bourgeois " or " proletarian ", that a host of falsifiers are offering you in abundance".

Merton would formulate the famous four principles of scientific ethos, one of which stresses the universality of scientific pursuit. Thus, the second wave contributed to strengthening the scientific ethos which, though disdained by the Soviet regime, would remain a beacon for a good part of Soviet scientists throughout the years.

Trotsky, at that time a prominent leader of the new regime, justified the deportations as " preventive humanism ". While acknowledging that the exiles were " politically insignificant ", Trotsky branded them as " potential weapons in the hands of our possible enemies " who would be executed in the case of a war. " This is why we preferred to exile them now, in a quiet period, beforehand ". While Trotsky's arguments strike as rather far-fetched, he actually did act as prophet *malgré lui*. There is little doubt that most of the deportees would have indeed perished in the purges in the 1930s.

A few prominent scientists left the Soviet Union in the early 1930s. The Soviet government tried to convince them in 1936-37 to return to the Soviet Union - in vain. It was quite clear that a return to the Soviet Union meant certain lengthy imprisonment and often death.

Some of the emigres of the 1930s became prominent leaders of their respective fields in the new country. They joined earlier emigres some of whom, like I. I. Sikorsky or V. K. Zworykin, had attained fame as talented engineers and inventors, associated with helicopters and television, respectively. George Gamow became known for his work on atomic nuclei and the properties of elementary particles. Another Russian scientist, Vladimir Ipatieff, an eminent chemist who arrived in the United States at the age of 62, brought with him unique expertise in catalytic organic

chemistry which he successfully introduced into American petroleum industry. During his two decades in the United States Ipatieff authored scores of scientific papers and industrial patents, and trained dozens of specialists in catalytic petroleum chemistry. Several decades later, Soviet chemists concerned about the decline of the science of chemical catalysis in their country would seek Ipatieff's American disciples in the framework of Soviet-American scientific exchanges.

In the period of 1923-73 there were no waves of emigration of scientists even though prominent scientists escaped during a trip abroad. The third wave began in the early 1970s, and consisting primarily of Jews, it lasted intermittently until emigration was liberalized and dedramatized in the early 1990s. Some emigres had achieved prominence as *refuseniks*, i.e. applicants for emigration who were refused an exit visa and who had to endure years of persecution of various degrees. Given the relatively high proportion of scientists and engineers among Soviet Jews, this mass emigration resulted in resettlement of thousands of Soviet-trained specialists in Israel, the United States and a few other countries.

The third wave of emigration failed to include or produce scientists of such stature since it was a flow controlled by Soviet authorities mindful of their own strategic interest. The issue of emigration of scientists had been a taboo till very recently but it acquired a politically correct aura with the disappearance of Communism. A book and several articles were published in the late 1980s and early 1990s which, for the first time in Russian historiography of science, undertook an analysis of the phenomenon of Russian scientific emigration in his century.

In the last years of the Soviet Union, scientists of diverse ethnic provenance reacted to the shrinking science budgets and the novel freedom to travel and went to do research in many countries of the world. There was a wide-spread fear of a massive loss of scientific talent in Russia in the early 1990s. Throughout the history of Soviet science, the regime failed to use scientists in an efficient manner, with the exception of military projects. Emigration was therefore hardly an impediment to the country's scientific growth. In the 1930-70s the state came to rely on an abundant supply of young scientists. In the late 1980s, the country's science began to contract, and the outflow of personnel from science was directed primarily towards other pursuits within the Soviet Union, rather than to other countries. Some of the emigres adopted the so-called " pendulum pattern of migration ", splitting the year between Russia and a foreign country. Moreover, the collapse of the Soviet Union enabled scientists who had left on the third wave to reestablish contacts with their former colleagues and engage them in collaborative research projects. In this sense, the Soviet case of scientific emigration had a happier ending than emigration from Nazi Germany and Fascist Italy.

German Emigration: a Violent Rupture

The first government formed by the National Socialist Workers'Party of Germany lost little time to tackle its main ideological and racial enemies. Within a few months of the victorious election of 1933, most Jewish scientists were forced to resign their positions at the country's universities and research institutes. The following year, even First World War veterans were included in the purge. This prompted a massive emigration of German scientists, mostly Jewish but also those who had Jewish spouses. A few scientists who held strong anti-Nazi beliefs joined the growing wave of emigration. Several countries would benefit from this massive transfer of scientific talent : Britain, France, Holland, Palestine, Turkey, and, last but least, the United States. In some of these countries, such as Palestime (later Israel) and Turkey, German Jewish scientists built up local scientific infrastruture *ex nihilo* and had a lasting effect of the respective scientific institutions. As late as the 1980s, some would call the University of

Ankara or the Hebrew University in Jerusalem as " the last German universities in the world ". Indeed, universities in both Germanies had undergone profound changes under Western and Soviet influences while these " colonial " relics remained true to the tradition of the founders.

Holland, Germany and other Continental countries derived a passing benefit from the inflow of German emigre scientists. Most emigres look for more permanent abode in England and North America, and with the approaching of World War Two a second exodus began from the Continent. The impact of German emigre scientists on American and, to a lesser degree, British science has been amply documented. The most significant effect was no doubt the acceleration of the transfer of the world centre of science from Germany to the United States. This phenomenon had begun in the wake of World War One when German science came to be boycotted for several years by most Western scientists. The advent of National Socialism and the ensuing emigration of a large number of world-renowned scientists cast a *coup de grace* to the central position of German science. Since the 1940s the centre has been firmly implanted in the United States. It is undeniable that the emigration of scientists from Germany was a clear gain for the host countries. But how much of a loss was it for German science ?

Approximately 40 % of all university instructors inherited from the Weimar Republic were dismissed under the racial laws. Another estimate suggests that about half of all scientists and highly qualified technicians left the Reich by 1938. Early responses from apolitical scientists made it clear that the emigration had destroyed entire fields of inquiry and debilitated many more. However, in the euphoria of Hitler's first years in power these were deemed " legitimate " losses. Moreover, replacement of Jewish scientists opened up fast-track promotions for hundreds of scientists who thus came to appreciate the practical benefits of the new regimes's racial ideology. It was only with the beginning of the war that Hitler and his allies realized the gravity of the situation. But little was done to remedy the shortage of qualified manpower. In this respect, Hitler did not imitiate Stalin, who organized imprisoned scientists and engineers into sharagas, where intensive R & D work, particularly in the defense sector, was conducted in the 1930s and 40s. Moreover, while Stalin practically stopped all emigration in the course of his Great Terror, Hitler encouraged it through a combination of policies of exclusion and relatively liberal exit rules. Apparently, Hitler never shared Stalin's famous belief that " the cadre decide everything ".

Nuclear research is one field universally recognized as that of significant loss for Germany. Indeed, while opinions vary as to the real devotion of remaining German scientists to build the bomb, it is clear that the emigration deprived German science of its major potential in the field. The closely related field of theoretical physics, mathematics, various branches of industrial technology lost significant figures who not only did major professional work in exile but, more importantly, had occupied key innovation positions at such science-intensive and defense-related industries as Siemens, AEG and Krupp. The loss was acknowledged by experts on both sides of the divide in World War Two, Goering and Churchill.

After the end of the Nazi regime, relatively few German scientists returned home. Quite a few had reached positions of prominence in their adoptive countries where they had often worked for over a decade. Many harboured resentment against their " Aryan " colleagues who had stayed in Germany and continued their work. In the polarized atmosphere of the post-war years, those who stayed behind were often considered collaborators of the regime, and there was little inclination on the part of the emigres to risk their overseas careers in exchange for the dubious pleasure of joining in the re-building of German science. While some positions became vacant due to de-Nazification, emigres were seldom candidates to fill them. The rupture of German science became irreversible.

Italian Emigration: A Valiant Few

Italian Fascism up to 1938 was characterized by policies of rather inclusive societal mobilization. Jews took an active part, on a par with the rest of the population, in the institutions of Mussolini's Italy. By the time Mussolini assumed power, Italy was no longer an important centre of science. At the same time, there were pronounced differences among scientific disciplines, e.g. mathematics was better developed than physics. However, the Mussolini government stimulated important work in theoretical physics by opening new university chairs in Rome and Florence and providing state support for research.

This growth was brought to a halt by the " Manifesto in the Defense of the Race ", as was the official title of Italy's racial laws promulgated by Mussolini on July 14, 1938. Five physicists who had played crucial roles in the brief resurgence of physics in Italy emigrated. Three, Bruno Rossi, Emilio Segre and Giulio Racah, had lost their positions and civil rights. Enrico Fermi, married to a Jew, followed suit. Finally, Franco Rasetti " did not want to live in such an uncivilized country ". The feelings provoked by the Manifesto among scientists were best described by Primo Levi, a chemist who did not emigrate, was deported to Auschwitz, and became a world-renowned author after the war.

The pattern of motivations for emigration was quite similar to that observed in Germany and Soviet Russia. Dozens of younger scientists also emigrated, including Bruno Pontecorvo who, along side Fermi, would play an important role in the history of the atomic bomb, a project beyond the means of Italy whatever the political regime. Most of these emigres would restore professional links with their native scientific community but they would return for vacations or after retirement. The loss for Italy's physics was irreversible. Similar losses were sustained in mathematics.

Like in Germany a few years earlier, the emigration opened new avenues for professional advancement in the sciences. Some of the remaining scientists not only passively benefited from the effects of the Manifesto. They went as far as to have their Jewish colleagues excluded from international scientific institutions still domiciled in Germany. While German scientists could not, or would not, tell a Christian Italian from a Jewish one, their Italian colleagues obliged by written denunciation.

The return of Jewish academics, who had hidden in Italy or survived the German camps, to Italian universities was not made easy. Their old positions had already been occupied by their Christian colleagues. The vast majority of the latter were not active Fascists. They were, rather, fellow travelers, to use the term applied to the majority of German scientists in Nazi Germany. They had no reason to vacate their new positions which occasionally created tension. But, most importantly, Italy was poor, devastated by war and hardly attractive to scientists who had emigrated and continued their scientific careers in the incomparably more prosperous United States. While the period of their emigration was not as long as for their German or Soviet emigre colleagues, all three groups would be reluctant to return en masse to an impoverished, dejected periphery of science which they saw in their native lands.

Conclusions

The three cases of emigration of scientists have very different time spans. The Soviet emigration developed in three discrete stages : 1918-20, 1922-23, and 1970-91. It comprised thousands of scientists and was, by all counts, the most massive migration from any totalitarian

regime in this century. Germany's totalitarian experience is much shorter, and even within this shorter period, emigration of scientists occurred in the course of three or four years. Italy lost its scientists in much smaller numbers and during a much shorter period, practically within one year, summer 1938 to summer 1939.

Scientific comportment of the emigres also differed. Russians of the first and the second waves considered their exile a temporary punishment. They built up a cohesive international community which functioned for several decades, overlapping with the general scientific community, and thus preventing provincialization. Ethnically and religiously linked with Russia as the centre of their identity, these scientists preserved a distinctive collective identity which could no longer be found among the emigres of the 1970s and 80s.

Scientific emigres of the Brezhnev, or stagnation, period were mostly Jewish who saw their emigration as an act of redemption rather than punishment. They made no effort to preserve a distinctive collective identity. Rather, they tried to merge with the host scientific communities and make the best of it. They came to use international languages of publication rather than Russian since no Soviet journal would touch submissions from an emigre with a barge pole. Whatever the causes, in this sense, the behaviour of the third wave of Soviet emigres is comparable to that of the German and Italian emigres. The latter were also mostly Jewish, and they would have experienced similar problems had they chosen to publish in their native tongues, which also meant their native lands.

Several national sciences benefited from the outlflow of scientists from totalitarian countries. Unlike other cases of migrations of scientists, emigration from Nazi Germany, Fascist Italy and the Soviet Union brought to life strong movements of solidarity on the part of scientists in the host countries, primarily Britain, the United States and, in a different sense, Israel. Reception of the refugees was not always smooth. Tensions invariably developed in host institutions whose operations, processes of promotion and reward were disrupted by the inflow of foreign scientists. However, the sentiment of solidarity among scientists, often relying on sympathetic policies of the host governments, resulted in professional positions for the vast majority of the emigres. Turkey and Israel gained significantly in both qualitative and quantitative terms : their scientific communities were largely built up by German refugees and, several decades later, were strengthened by the inflow of Soviet scientists, mostly from the Soviet republics of Central Asia into Turkey, and from the whole of USSR into Israel. The United States and Britain gained mostly in qualitative terms as entire scientific fields were transplanted from Nazi-occupied Europe. The role of German emigres in the nuclear arms projects is an outstanding case of such impact. Soviet emigres of the 1970s reinforced several fields, such as mathematics, and greatly improved the quality of scientific training on various levels. Thus, emigration from totalitarian countries brought immediate and long-term benefits to the host countries.

The loss sustained by the scientific communities left behind varied widely. The massive outflow of scientific talent from post-revolutionary Russia was just another factor of disruption that Russia's science suffered in the wake of the revolutions. Their absence would not be felt until the first Five-year plan which ushered massive investment in science. However, in the intervening decade a new cadre of scientists were trained, and new centres of excellence, such as Kharkov in physics, were put on the map. It is also questionable whether the emigration beginning in the 1970s constituted a loss for Soviet science.

The fact that many young emigres developed splendid scientific careers in the host countries does not automatically mean that they would have developed them in their native lands. At the same time, senior scientists who had attained an international status and visibility were usually prevented from emigrating by Soviet authorities. Moreover, by the time this wave of emigration was under way investment in Soviet science had begun to peak. Soviet leaders had come to lose the traditional belief in science as the omnipotent saviour of Soviet economy. Thus, the gain to Israel and the United States from thousands of Soviet emigre scientists was not neces-

sarily commensurate with the loss sustained by the Soviet Union. Migrations of scientists rarely constitute a zero-sum game.

The losses to Germany and Italy appear more pronounced. The emigration deprived Germany of a broad status of senior and advanced scientists. While the Soviets controlled the outflow of scientific talent, neither Germany's Nazi leaders nor Italy's Fascist government would impede the exodus of scientists. Consequently, entire fields of science were left if not deserted, at least decapitated. Thus emigration contributed to the loss by Germany of its central position in world science, and deprived Italy of a few pockets of excellence that the Fascists had themselves tried to develop.

Migrations, Networks and Scientific Communities

Part II

Migration and Construction of Scientific Cooperation The Case of the Caldas Network

Jorge Charum

International scientific migrations have been the object of renewed attention in the last few years. The recent fracture of the research systems of the countries of Eastern Europe is one of the elements that have contributed to put in the agenda of sociology of science and technology the subject of more or less permanent movement outside of their national frontiers of a large number of scientists.

The interest to understand the relative success shown by the new policies for repatriation of nationals of the countries of Southeast Asia and their implications in their accelerated industrial development, the permanent interest to exceed the level of the simple evidence of the fact itself and advance in the understanding and explanation of the migratory phenomenon, from the underdeveloped South to the industrialized North, are other elements that have contributed to his renewed interest. On the other hand, beyond the understanding and the explanation of the phenomenon is the interest to establish national policies that will permit to orient the flow of knowledge, competences, experiences and elements -which today are proper of the dynamics of science of the creation of new knowledge and of the innovations- for the benefit of a nation.

The notion of brain drain, which permitted to face the study of these migrations, started to show its explanatory limits when it attempted to pass from general formulations to more particular studies and to the generation of policies that would offset the phenomenon (Meyer, Charum, 1995). These were reduced essentially to compensatory measures for the countries of origin of the migrations, encouraged by international organizations, or, in the case of national policies, to the granting of individual incentives to attempt to secure the return of immigrated scientists to their countries of origin. These national political actions were not able to give any considerable results.A greater understanding of the conditions that make possible the development of scientific and technological activity served as a reference to establish positive conditions that would make it possible to invert the direction of migration. The existence or the construction of local scientific structures that permit to receive scientists and technologists educated and with research and work experience abroad was at the basis of a new option for capitalization of expatriate national capabilities, called brain gain, and of which the most evident examples correspond to countries from Southeast Asia: South Korea, Taiwan, Hong Kong and Singapore.

The analysis of this model of brain gain in its most developed version permitted to establish a) the particular and specific circumstances in which an accelerated industrialization process occurred ; b) the sense and implications of the establishment of research centers, connected to the needs of the industry and which made it possible to display a policy of repatriation of trained researchers and engineers who performed research work in the immigration countries (Chaponnière, 1991). However, the specific conditions that permitted this do not find an analogous situation in other countries of the South, making this version of the brain gain model irreproducible for them (Peemans, 1988).

The existence of a social web that permits the circulation of problems, researchers and engineers, of financing, samples, inputs and information, the preparation of joint projects is, in general, the result of multiple prior interactions between the actors of the research (the research groups) and

the users of the results. This web, the initiation of which in the case of developed countries may extend to the Middle Ages (Disco, Rip van Der Meulen, 1992), has been the result of long developments, accumulations and of the construction of implicit regulations and explicit rules that permit to orient the relations of cooperation and the performance of common projects among the different actors who connect the scientific and technological poles and the system of social needs.

Recent results of sociology of science and technology have permitted to understand the role played by these long accumulations. The characterization of the educational processes of scientists and engineers and of their insertion in research groups and in the knowledge production networks have shown : a) that the scientific activity is essentially a collective activity and that it mobilizes a complex technical-operational organization that must be available for the display of the possibilities for creation of new knowledge and the production of innovations ; b) that for this same production and creation the implicit learning and knowledge integrated into a new extended collective practice come into action and that, thus, the insertion of a scientist in new research traditions requires the time that will permit this socialization, which, then, does not secure the immediate circulation of scientists as such, and c) that every scientist or engineer is by itself a network, an actor-network, where multiple knowledge, competence and aptitudes interweave, which find their realization in their own activity and that, this activity in turn, is displayed within a network of socio-cognitive relations in which their colleagues and their own competence enter, as well as the instruments and the knowledge about them, the documents and the results produced by others, the financing and the resources and implicit or explicit messages that accompany their attribution on the part of the entities that provide them.

Thus, the problem of the migration of scientists, of their integration in new local research networks, of their international circulation, of the creation of relations between different traditions for making science or between different geographic contexts must be undertaken taking into consideration these new perceptions and evidences.

A new possibility for recovery of the national scientific capabilities starts to be outlined from experiences and projects of the own countries of origin of the migrations, a possibility that is located within the brain gain option since they tend to recover emigrated national capabilities, but not having as a basic purpose the return of the country by those who have such capabilities. To the contrary, it is considered that the emigrated scientists and engineers, by their educational processes and their assimilation of scientific traditions in the places where they perform their activity, of incorporation of competence, experience and learning through their research or work practice may be mobilized in their places of residence to cooperate and support the project of making science under the national conditions of their countries of origin : lack of large accumulations in the field of science, existence of local scientific traditions, generally not coinciding with the standardized forms in the central countries in the field of science, shortage of resources that will permit continued research efforts. The possibility of capitalization of this competence abroad to national frontiers has given rise to various proposals that are originated in the countries of the South.

This communication constitutes an attempt to locate potentialities and limits of this new brain gain option, the option of groups of expatriate scientists, which becomes concrete in a project of construction of the network of Colombian researchers, the Caldas network, which for its performance seeks to articulate the contributions from multiple actors, scientists and non-scientists, belonging to the interior community or to the groups of emigrated scientists and engineers, from the institutions that orient the national scientific policy, that carry out research activities, to the same research groups and to the users of the achievements made : disciplinary communities, teaching system, firms. The idea is to conceive new cooperation and collaboration modalities with the communities of origin and with research groups that will permit to respond to the demands for the creation of new knowledge and innovations without the full satisfaction of the accumulation and scientific tradition conditions.

The Case of the Caldas Network

The Caldas network is a social object under construction. The results obtained permit to establish its genesis, formation and consolidation. These times of its construction and development will be studied from the statements made by those who were its determinant actors. For this purpose interviews were made in various countries by researchers associated to the project "Brain drain revisited through the Colombian case. Study of the Caldas network" [1]. The perception that on the network have its members will be supplemented by some of the results of the Colombia Networks survey. This first part permits to capture the social dimension of the Caldas network at a microsociological level, that of the creation of new knowledge and social structures by the direct action from and between actors, of the learning and standardization that these actions progressively constitute and the sedimentation of which is an acquisition that becomes the basis for the development of subsequent actions. The characterization of groups differentiated by their positions against the contributions they intend to make and the benefits that they think they will obtain for their participation in the network, will permit to capture a second level of the social dimension of the network.

The second part seeks to establish the scientific and technological potentialities on which the passage to its establishment as a socio-technical network may be supported through the identification of that which already exists, the location of the devices and of the cognitive elements mobilized and that can be mobilized, which constitute the socio-technical accumulation of the network, and that become a common fund available for a research community. For this purpose scienciometric and infometric methods for the analysis of publications, of research subjects, of disciplinary profiles will be used that will permit to connect that which appears in a scattered manner to force the aggregations and the internal structuring of the different elements.

In the third part some conclusions and orientations will be extracted for a realization of expectations : become an artifact that will permit to orient the political decisions in the field of science and technology in a developing country that attempts to advance in the autonomous production of knowledge and innovations oriented by national needs.

The Caldas Network as a Social Network

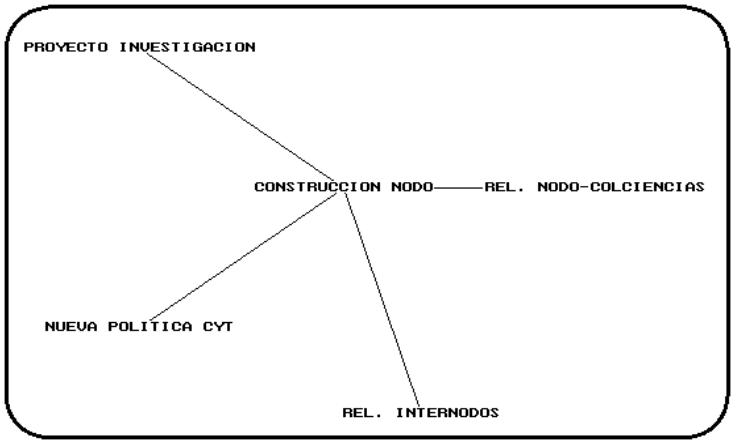
The constitution and consolidation, still in progress, of the Caldas network is a complex process in which multiple factors take part. At its start, marked by the explicit interest on the part of the State to internationalize science and technology, to expose them to the quality and evaluation standards, the project finds its support in the willingness and interest of emigrated intellectuals to work for the country and in the research groups established in Colombia to initiate work relations with researchers settled abroad. The call in order that those who participate in research networks abroad become evaluators of the national projects presented to obtain financing, the making on the part of Colciencias -the institution that is in charge of orienting the national scientific policies- of a new commitment that seeks the articulation of the internal scientific community with the emigrated researchers, who can then be considered active members to participate in the orientation of scientific policies and be recognized as active members abroad of the national scientific community, created the conditions to start a mobilization around what can be considered as elements of a new social pact in the field of national science and technology. As of the analysis of seventy-three interviews performed during 1994 and 1995 it is possible to establish the modalities taken by the commitments by the different actors and the actions displayed in the process of constitution of the network. The interviews were oriented to establish the perception that existed on the proposed network, the level of relationship

and commitment awakened by the project in its construction and the actions that were seen as necessary and in which the interviewed person eventually participated or believed that he had to face. A data base was established with these interviews. Each one of them was considered a document to which a series of descriptors or keywords were assigned which permitted to establish the contributions by the persons interviewed to the formation and consolidation of the network, their position with respect to it, the subjects of interest for them and the problems that they found for their development as a research network. The simultaneous presence of several themes in the documents was interpreted as associations and relationships between them made by the person interviewed and considered important by him.

This permitted, based on the method of associated words [2], to establish a topographic map which represents the effects of the individual activities but the joint effect of which is determined as general qualities and characteristics of the network. The three clusters located in graphs 1 to 3 are shown. The name assigned is that of the interior keyword which is more related to the others.

Construction of the Network (Graph 1)

The reception and expectations generated by the official discourse on the new national science and technology policies put into action, initially without limiting the participation, advanced students, researchers with experience, practicing professionals whose relationship with the country, in most of the cases, are rather distant or critical.



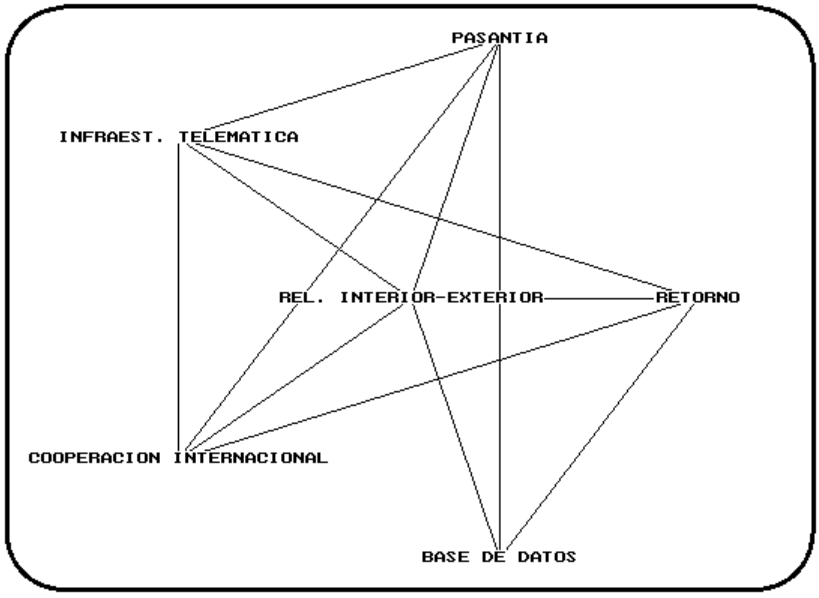
Graph 1. Cluster : Construction of the network

In the process of construction of local associations or nodes [3] one of the first problems that had to be solved was to count with an operation infrastructure that would secure continuity : meeting places, technical means for communication by electronic means, clarification of the relations of nodes with Colciencias -state institution from where the initiative to connect immigrated nationals originated-, and of the ties with other nodes of the network. The construction of the nodes is the result of the localized action by social actors that make up and define the social space, negotiate the conditions of their existence and permanence with the interested institutions, establish internal operating and administration modalities. The official discourse is taken into consideration to disclose the activities but the local strategies, put into operation by the members are the one that articulate the supplementary action of the various actors. The cooperation of local consular services, permitted to increased the capacity to call upon Colombians abroad and resolve immediate material problems : meeting places, accesses to communication media, dissemination of internal documents.

In this first phase of construction of the network, a reflection was undertaken on the sense and orientation that a network of researchers abroad should have and the type of relations that should be held with the country. From the point of view of the purposes of the network, it was considered a priority to clarify the type of research projects that can be established with Colombian groups, and their orientations, which leads to mediate on the ties that should exist between research and industry, between the latter and the university and, in general with the scientific pole, and on the actions that would permit an approach among all of them. The discussions already show a finer perception of the problem of the usefulness of research, clearly induced by the members of the group of expatriate scientists whose experience has shown to them that an oriented research activity is a common practice in industrialized countries, which is in contrast with the weak articulation of the scientific and technological pole existing in Colombia.

The internal and external relations of the network (Graph 2)

The appearance of the network was supported by local associations already present among Colombian members, particularly in the Colext network which connected through an electronic mail list, many Colombians abroad. The differentiation and the constitution of the Caldas network as a unit with its own identity, prompted during the first phase of its constitution, discussions on the reality of the statements about the new scientific policy, its relevance, orientation, origin and the place that could be held there by a new association of intellectuals interested in the development of the national scientific capacities.



Graph 2. Cluster: Internal and external relations

The dynamics of construction of the network progressively induced differentiation's in its interior based on the levels of education, on the work areas and on the conditions under which the study, research or work activities were carried out by the associates. A first differentiation establishes a hierarchy between advanced students and practicing researchers. It was considered that the former still had to travel the way which would permit them to insert themselves in the local research networks and that their current expectations on the benefits that the network could provide to them were more related to their professional future than to their current situation, while the latter were those who, based on the recognition gained and on the expertise they had, could effectively achieve the cooperation and reach concrete results : contributions from their specific position and expertise, capability to propose and carry out joint projects, to nego-

tiate with entities within their work area, of obtaining resources and financing, of orienting and inducing transformations in the national science and technology system. They could, in addition, contribute from their specific knowledge to the technical infrastructure of the network. Thus, for example, the communication by electronic means, by the members of the Paris node is carried out under the direction of an specialist in the field.

A second differentiation started to be outlined between social sciences and humanities, on the one side, and hard science and technology, on the other. Associated to the local work densities and traditions of each one of these groups, it made evident a struggle for the definition of the network's political orientations. The participation by the representatives of applied hard science while specialists in their field, was accompanied by considerations on the development conditions of the network and its practical orientation and by this, they penetrated into the field of the practice of sociology and science policy, a domain that is considered proper of social scientists. The preparation of different concrete projects (in computer science, physics, medicine, for example) gradually specified the actors in the field of science and technology, while the preparation of events which undertook the consideration of the characteristics of making science, the status of national science or the contemporary modalities of evaluation of the scientific activity were considered activities proper, although not exclusive of social scientists. This differentiation permits to reach a specificity in the actions carried out due to the work areas - the mobilization around concrete projects on the part of the former, actions more of a *forum* type on the part of the latter - and has as a possible consequence a complementation the fruits of which are still to be seen.

Other attempts for differentiation according to the areas correspond to the creation of electronic mail thematic lists the results of which are not yet concluding [4]. On the other hand, the adhesion around concrete projects gradually close qualified participation. In this is perceived a characteristic of the networks : on the one part they are constructed by the successive adhesions, of solidarity progressively found in an increasing number of actors, but these adhesions are made around concrete subjects of projects that close the participation by those who are not qualified on the subject or the problem undertaken. The advances in these specific technical-cognitive differentiation's may be appreciated making a follow up of the projects in progress [5].

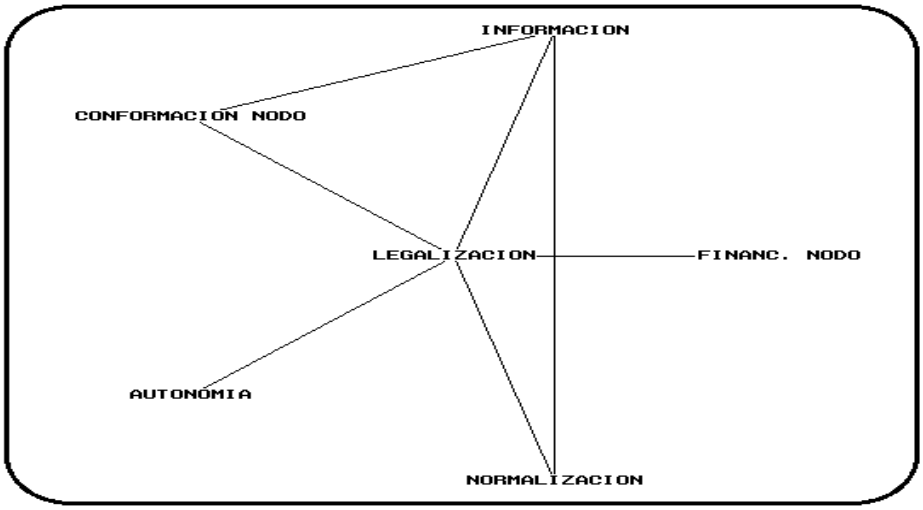
Strongly associated to the specification of the relations between the network and its exterior is the clarification of the conditions for reinsertion to the national scientific web by those who count on returning to the country and of the concrete forms of the return policies. The disposition of a information structured becomes then critical. The establishment of data bases that will permit to establish research dynamics in the country, the accumulation of knowledge and expertise present in the network, the disciplinary and educational profile, the projects underway or completed is perceived as one of the conditions that must be rapidly satisfied since it is considered that both the return expectations and the capacity to look for new resources through international cooperation, to constitute teams that from different places and with complementary expertise may establish agreements to work in specific projects, must be supported by reliable, structured and updated information. The idea is, then, to take advantage of the characteristics of the networks to propose alliances based on the ability to complement available expertise, distributed in the network, a kind of virtual research laboratories that will permit to put into movement the contributions oriented to specific objectives from any place in the world where they may be found.

The existence of a structured information must be complemented by an increased capacity of access and circulation which will permit to support the requirements and accelerate the speed of transactions, of exchanges, of negotiations. This consideration reflects a critical position on the management of time of negotiations, of making of decisions on the proposals presented and the assignment of resources on the part of national institutions and to the negative effects that they have on the relations with those who consider that the decisions must be followed by the

actions derived therefrom. Thus, distances start to appear between a willful discourse supported by the national research operators and the increased demands of those who, by accepting the new options that the official discourse opens, acquire a greater capacity to propose the performance of projects and do not find a fast reaction to such demands.

Learning and its incorporation to the network (Graph 3)

The constitution of the first nodes that reach a relative development generated a series of learnings that were mobilized for the construction and mobilization of others. It was accepted that the network takes its nature as such if it passes from its local level, to a regional level and subsequently to a worldwide level. Each one of the nodes is already a social network, which is expanded when other nodes are created, and relations with it are established and determined. The notion of social network is progressively determined and is oriented, above all, by the ideal that its construction is due to the joint action of those who take part in it. The technical means are determinant for it and, specially, the access to an electronic communications network, the R-Caldas : Internet and the electronic mail are going to play a critical role in this phase of the organization and of intensive communication. Thus, the construction, the creation of an operation infrastructure and the expansion are problems perceived as complementary by the different actors of the network.



Graph 3. Cluster: Learning and accumulation

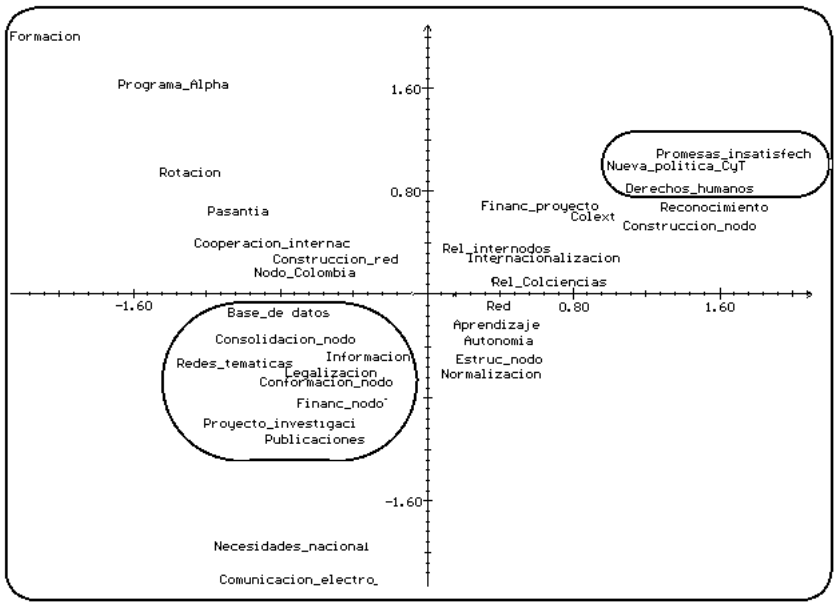
During the phase of creation of the nodes, attention was paid to determine their position with respect to Colombian institutions. In addition, it was considered necessary to have, with respect to local, regional or internationally oriented institutions, a legal status that would constitute each one of the nodes into a local unit and all the nodes as a whole into a global unit on behalf of which it would be possible to talk and negotiate. This *legalization*, gave rise to a specification of the administrative functions and to the appearance of different levels of commitment between the members : the coordinators of the nodes, undertook then an intensive activity of disclosure of the interests of the network and of co-optation among the members of the group of expatriate scientists abroad. Different types of solidarities to answer for the needs for administration, obtaining resources, construction of technical means were gradually determined. Thus, for instance, if basic financing of the administrative infrastructure is demanded from Colciencias, it is complemented by resources that come from other sources : from the laboratories to which the researchers belong, to projects in progress, from personal funds...

Connected to the legalization is the need for *autonomy*. Autonomy with respect to national institutions, with which there is coincidence in a common project but there is a tendency to guarantee to the own actors the possibility of establishing the modalities of its development and orientation. It is considered that the same orientations of the national scientific policy must now count on those who have performed work in the area of science and technology; that the research projects to be registered as accomplishments as of the possibilities generated by the network must be the result of proposals the orientation and development of which respond to the interests proper of the actors of the research, even if these proposals must be subject to assessment and supported by funding and resources. The differentiation is progressively established between the actors of the research - those who perform the research - and the operators of the research - units that encourage, finance, organize, control, assess the research, but whose operating environment should not penetrate the processes of performance of the research activities.

This autonomy so conceived, the specification of the functions of the actors and the operators of the research, the learning resulting from the processes of conformation and consolidation of administrative structures, the acquisition of a legal status that will permit to undertake, with a high degree of representativeness, negotiations and propose projects, are conditions acquired by the network. It is this ruling of the conditions, integration of learning, definition of rules, generation of implied regulations which now permit a mobilization of the various actors to seek associations, propose collaboration and joint projects, obtain the cooperation from national and international organizations.

Positions with respect to the construction of the network

The analysis of the *corpus* of keywords resulting from the interviews through the statistical method of simple correspondences (Graph 4) permitted to establish other forms of groupings that show various positions and attitudes by those interviewed with respect to the project of construction of the network. A clear division is found between those who, on the one part, tend to adopt a more reflexive position on the theoretical conceptions that must orient the construction of the network or on the political implications that its construction will have, and those who, on the other part, adopt a more constructive and pragmatic attitude. In this first position the problems of the connection between autonomy and financing, of definition of the relationships between the nodes or of the conception of its internal infrastructure are assumed at a theoretical level.



Graph 4: Interviews by simple correspondence

Characteristics of it are the questions on the sense of the constitution of a new form of association promoted by the State when there is an experience of many promises not satisfied, or when it is possible that this association will achieve an international recognition in the field of science and technology and notwithstanding it the national situation of human rights continues being very critical.

The other grouping permits to locate a more active attitude that tends to the institutionalization of the network and the construction of the elements that permit its consolidation and operation. Thus, the preparation of data bases -which would permit to establish the dynamics of the publications and of the research- the creation of lists that will group the specialists, the consolidation of the nodes as units with negotiation capacity, the circulation of the researchers, the preparation of proposals of cooperation and of development of projects with the researchers of the interior community are the tasks assumed from a constructive attitude that will actively involve them.

The multiple positions with respect to the network

The above analyses, based on the interviews made to members of the network, the majority of which had at the time of their performance an active commitment with it, may be supplemented with results from the survey Colombia Networks, carried out during 1994-1995 [6]. The results obtained show that if the expectations with respect to the network, the expected benefits and the contributions to be made to it are taken as reference, it is possible to locate six groups within the two sets of researchers who answered the survey, three according to the answers coming from abroad, three for the sample of 40 researchers who work in Colombia.

The first group, the weight of which among the total of 453 answers is 144, is represented by those who do not believe that any benefit is to be obtained for belonging to the network. They do not show any interest about establishing academic or work relations, either by participating in courses or as advisors, evaluating projects, receiving researchers or contributing to provide research means. A distance with respect to the country or its needs leads them to not wishing to visit it, not wishing to have ties with the emigrated community. They do not believe either that the network will be a means that will permit to strengthen their position in the country of residence, gain a recognition in Colombia for their work, or that through the network new perspectives for their work would be opened in Colombia or in their place of residence. There is a great probability that a representative of this group may be working in the United States, will have there a stable work position and that his age will be within 40 and 45 years of age.

The second group, the weight of which within the total is 149, is made up by those who do not give any opinion on the benefits that may be received for their membership and do not say anything about the contributions that they could make to it. However, it is not possible to rate them as indifferent because they do not share the idea of those who do not want to visit the country, or are not interested in having relations with the researchers of the country, since they perceive that there is a way in for possibilities to carry out projects, to obtain financing and to have an incidence on scientific policy. Among those who participate in this position there is a great probability to find students who are pursuing a doctorate degree, which would explain their position connected to their uncertainty about the near future.

The characteristics that define the third group (160 over 453), are a lot more affirmative. An interest to join and strengthen the national community abroad, to make exchanges with the academic community within the country, participating whenever possible in courses and as advisor, proposing joint projects, evaluating projects, receiving researchers in their work place and making available the means to carry out research studies, shows his commitment to strengthen the community within the country. Those who form a part of this group would share the idea that making part of the network will bring them benefits since they would obtain recognition

for their work and results already achieved and would permit them to make contributions to the development of the country. With respect to the national scientific policy one of their contributions would be to make their experience and knowledge available to contribute to their orientation. Characteristics proper of this group will most probably be found among those who do not work and are under 29 years of age.

These results show that within the emigrated scientific community as a whole, not all become actors in the creation and consolidation of the network. In particular, those who share the characteristics of the first group have a pessimistic or at least distant position with respect to a project to which they do not intend to contribute actively or to obtain benefits from it. Only within the third group there is a new type of actors who orient and feed with their contributions the development of the nodes at their place of emigration and participate in the construction of the characteristics that progressively become accumulations within the network and actively participate in the creation of ties and development of work in cooperation with the interior community.

The analysis of the forty surveys that come from the interior community also showed the existence of three positions with respect to the network project. With respective weights of 13, 17 and 10 as to the 40 people surveyed, these groups are made up under the same positions as the three previous groups and differences are found only in the third group of which form a part those who wish to contribute to the orientation of the national scientific policy, seek an open space to the exterior by means of relations with the emigrated community and are willing to receive researchers at their work places. Thus, they are determined to contribute to the network, but, contrary to those who are abroad, do not expect any benefit from it, except maybe, to expand their professional contacts abroad and conceive their contributions as made to the development of the country.

Table 1

Subgroups within the network determined from their expectations of the benefits and contributions

	Cluster 1 Weight: 144	**Cluster 2 Weight: 149**	**Cluster 3 Weight: 170**
Academic or work relations	Disinterested	Does not know which may be	Curses, advisory work, research projects, trai-
	nee	established	at work site
Relations with the country	No activity	Uncertainty about his stay abroad or return to the country	Contribution to the development of the country
Relations with the emigrated community	Distant	Not very active participation	Active Proposal of joint projects Research means
Contribution	None	Uncertain. Possible contribution to scientific policy	Orientation of scientific policy. Joint projects Evaluation of projects
Benefits	None	Expectations on benefits, but still not clearly defined	Recognition

Source: Colombia Network survey

Table 1 shows the synthesis of the characteristics of the subgroups found in the group of expatriate scientists. The mobilization of the emigrated community is not fully secured and only close to 38 % (the percentage is reduced to 25 % in the case of the sample of the interior community) of them participates actively in the activities of consolidation of the ties between the interior and the exterior. These are the most dynamic actors who have turned to the interior the collaboration cooperation standards in effect in the international community and in the negotiation modalities to obtain financing, to transfer their assistants and themselves between insti-

tutions that find it natural to receive and send technicians, exchange products and samples, and which react with expedience and efficacy when the opportunities arise to construct joint concrete work proposals. The uncertainties about the future subsequent to the termination of the doctorate degree could explain the position of the undecided of the second group.

The Network as a Socio-Technical Network

The accumulations of knowledge present in the network

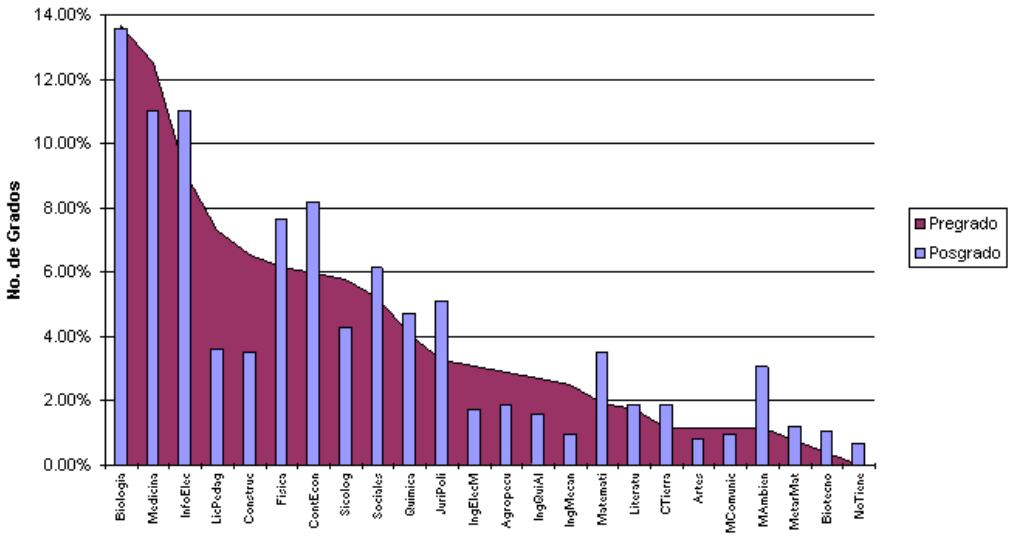
The accumulations in expertise and knowledge present and with a certain degree of availability permit the unfolding of actions intended to obtain results in the field of science and technology. The notion of network must consider then in parallel to the social dimension, the internal structure of the scientific capacities present in the network which becomes the reference to orient the efficient actions of the actors in the production of new knowledge or in the creation of the innovations. The action of the actors in mastering the construction of the nodes and, in general, of the network, the decision to contribute and the expectations of benefits permit to understand this social dimension but the sense of network does not extinguish there. The articulation between the social and cognitive dimensions is one of the contributions that, since Kuhn, has permitted to know about the necessary conditions that make it possible the creation in the scientific field. The theory of the actor-network extends the Kuhnian intuition and shows the complexity of the associations between the human and non-human actors put into operation in the dynamics of a socio-technical network. The idea is to establish the socio-technical universe in which it is supposed to operate. Thus, the question arises about the elements which may be counted on or which may become the basis for the scientific activity of the actors and in charge of orienting their action. These elements which have a nature as intermediaries, are contributions to the network due to the past education, past production or present activity of the members. They permit to create conditions, propose and make possible the interrelations between the actors, but their availability is only perceived when they have grouped together or have become related to the contributions of the entire community.

The socio-technical dimension of the Caldas network may be then considered according to the different temporalities, as past when it gathers the accumulations in the network due to the prior educational, research or professional activity of the actors, as present as it deals with the activity which is currently performed by its members, and as future, as a field of creative possibilities and space of policy. It is necessary, on the other part, to design devices and instruments of analysis that will permit the emergence of all the associations obtained based on the relations that occur between the elements. In effect, contrary to the social dimension of the network which refers to the direct relations between actors, here the purpose is to find the elements that will serve as intermediaries in the relations between actors for the performance of their interests in the field of science and technology.

Now, it is considered that these elements are the foundation of these accumulations that appear as present knowledge but distributed in the network, as expertise and education that may be geographically distant and which will only be available if their characteristics can be located and supplied with the means to access them. The idea is not only to make an inventory or description, even if these have their importance, but to prepare an information, to produce it, from basic information that will permit to show the aggregates and the implicit and explicit relations present between the elements of this aggregations and their availability. The notion of relation here is no longer of a face to face type, proper of social actors in a social network, but in a first time it occurs through elements of knowledge and establishes its structure and, in a second time, makes possible and even orients the relations between the actors. The making available of these cognitive elements is possible through primary recovery, organization and data treatment devices and of their preparation to produce a new knowledge. Now, this can only be achieved from a privileged *locus* from which it will be possible to observe the entire network,

its accumulations and dynamics and where the basic information which permanently comes from the network is processed [7]. In fact, the localized position of the actors only allows to have a partial perception of the entirety of a network and of the distributed accumulations and it is necessary, the to construct a "calculation center", a kind of central brain that will supply an updated, elaborated and specialized information.

Thus, we are interested here in the concrete modalities under which these accumulations appear. For this purpose, in the first phase, we will use some scienciometric indicators. Initially, the disciplinary profile of the network has been established in Graph 5, which corresponds to the groups of the present disciplines and which permits to establish the qualifications and expertise that its members have acquired. On the other hand, if we consider that the results reached in the research processes are object of publications, we can take as indicator of the activity carried out by the researchers the scientific articles, the book chapters, the conferences and even the reports published which are intended to a restricted public. Finally, in order to establish the dynamics, the current research themes and their connections will be shown.

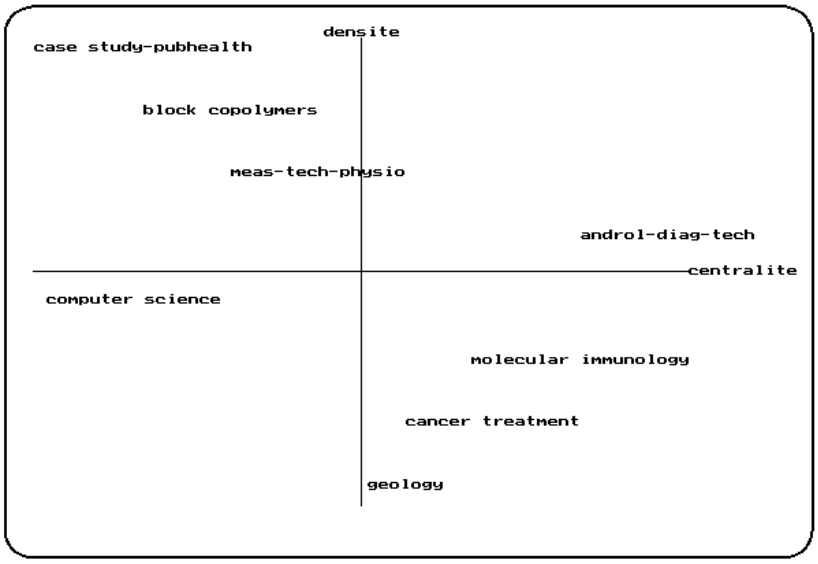


Graph 5. The Disciplinary Profile

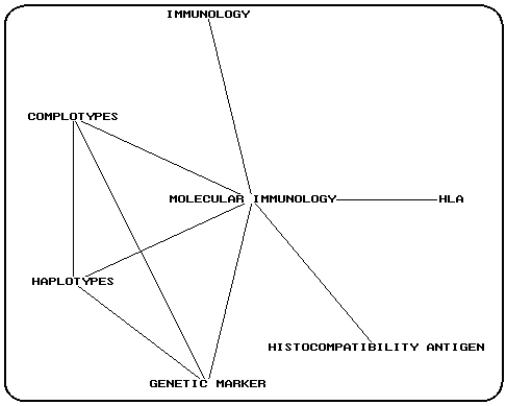
The publications as indicators of accumulation

The publications of the members permit to know who do what, with whom and where. At the time the survey of the Colombia Network was made, the list of publications was requested. Three hundred and eighty people surveyed sent the list of their publications. In order to make their analysis a sample was made of 10 % of the total considering the distributions by disciplines and by countries of origin of the publication. Each one of them was assigned keywords and the co-word method and the statistical analysis of multiple correspondences were used. Graph 6 shows the strategic diagram of the publications where the clusters are located according to the structural indicators of density and centrality. In the upper left quadrant there are the clusters that represent the themes with a high density and a low centrality, that is, which are relatively developed and mature but the problems on which the work is being done do not have any strong external ties with other themes. It is probable that these may be fields which in their evolution continue remaining relatively isolated. This is the case of the Block copolymer and measurement techniques in physiology, for example. In the lower right quadrant there are the fields with external ties (centrality value higher than average) although with a low density. It can be anticipated, then that their development will attract new researchers and that in their evolution will follow a trail that will make them move to the upper right quadrant. This is the case of the clusters Molecular Immunology or Latin America, for example. Graphs 7 and 8

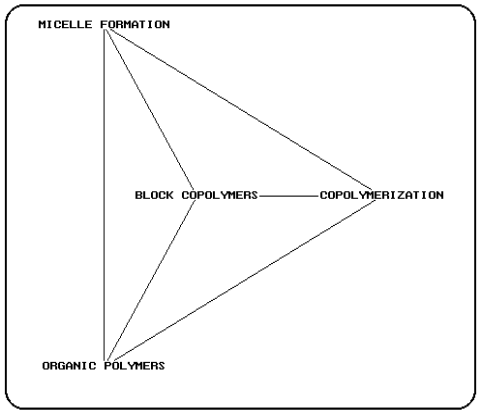
show the sub-themes represented by the keywords that form two characteristic clusters : Molecular Immunology and Block copolymers. On the other hand, it is found that, in general, there are few ties between the themes published by the members of the network which indicates that they are research fields independent from each other.



Graph 6. Publications Strategic Diagram



Graph 7. Molecular Immunology



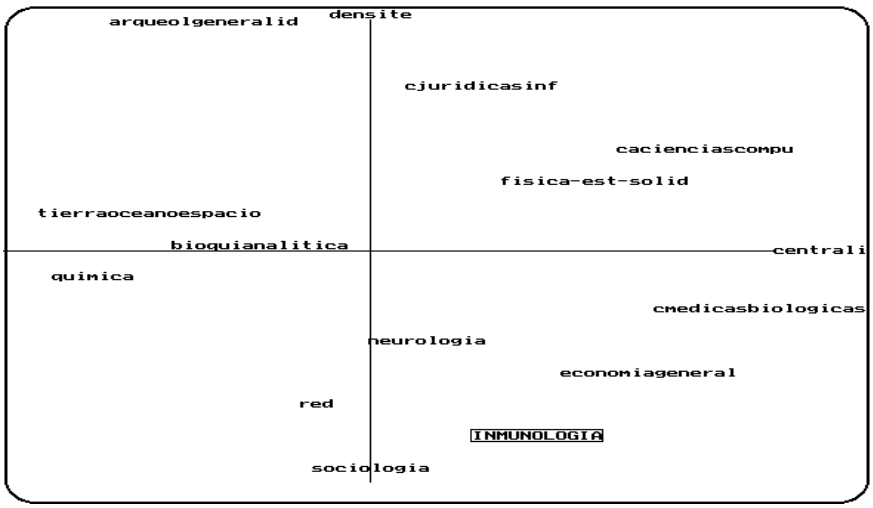
Graph 8. Block Copolymers

The comparison of these results with those obtained in the analysis of the publications by the interior community and present in an international data base [8] permits to point out some differences. For the case of the interior community, it was found that there are many relations between the different clusters which indicates a greater ability to complement each other among different research studies, an option by subjects that are connected to the national needs, specially in the case of medicine and health sciences, of earth sciences and natural sciences, which is in contract with the situation found for the case of the publications by the members of the group of expatriate scientists where there is a greater thematic association, which could be explained because these are publications by Colombian abroad who belong to other research networks, with different orientations and interests. What it is found is rather a thematic ability for complementation which can be used for the purpose of articulating the interior with the exterior around common problems. However, belonging to different research networks would make necessary the creation of the ties that would permit it.

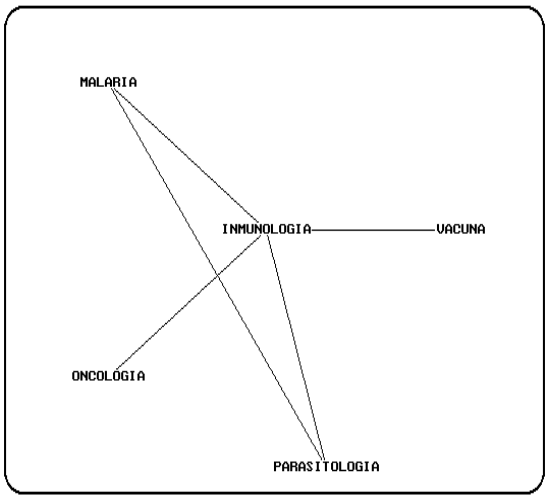
The map generated by the method of the simple correspondences for the case of the publications in the group of expatriates scientists permits to draw other conclusions. In this case is the existence of well represented themes (located in the exterior limits of the factorial plane) : ecology, nephrology, behavior sciences, for example which show research and publication activities relatively independent. To the contrary, and in coincidence with the above analysis, a closeness between various themes in Polymers. Computer sciences find connections with the communications and teleprocessing networks. A finer interpretation is possible locating the documents and their authors [9], which is possible returning to the data bases.

Research activities as indicator of the dynamic of the network

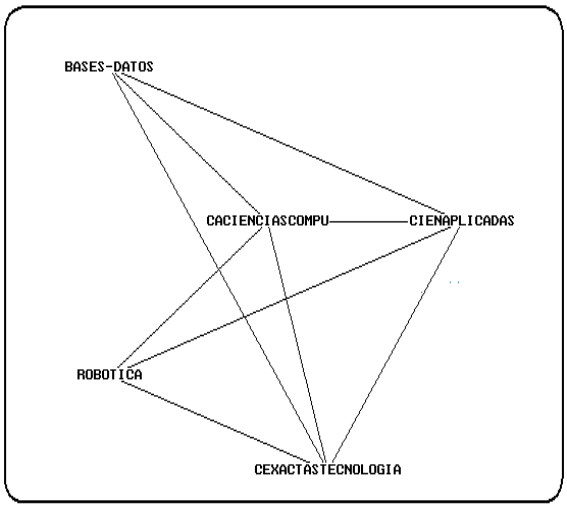
A third indicator corresponds to the research activities by the members of the network. This was established based on the assignment, on the part of the respondents to the survey, of keywords that described their current field of research, which permitted, based on the method of associated words, to establish thematic groups of work fields, their density and their centrality. The strategic research diagram in the group of expatriate scientists, Graph 9, shows the multiple research themes of the members of this group, and their distribution according to their density and centrality. Graphs 10 and 11 show the internal relations between the sub-themes that form a part of the Immunology and Computer Sciences clusters and the Graph 12 shows the external relations that the cluster Physics has with other themes, and which explains their position in the upper right quadrant. Also in this quadrant is represented the Computer Sciences cluster. To the contrary, the representation of the social and human sciences (Sociology and Psychology), as observed by their position in the strategic diagram is a lot weaker.



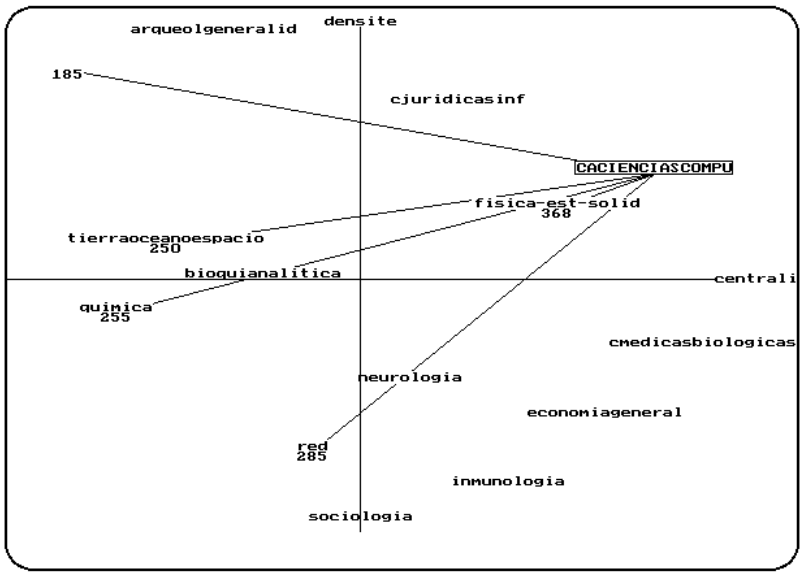
Graph 9. Strategic Research Diagram



Graph 10. Immunology Cluster

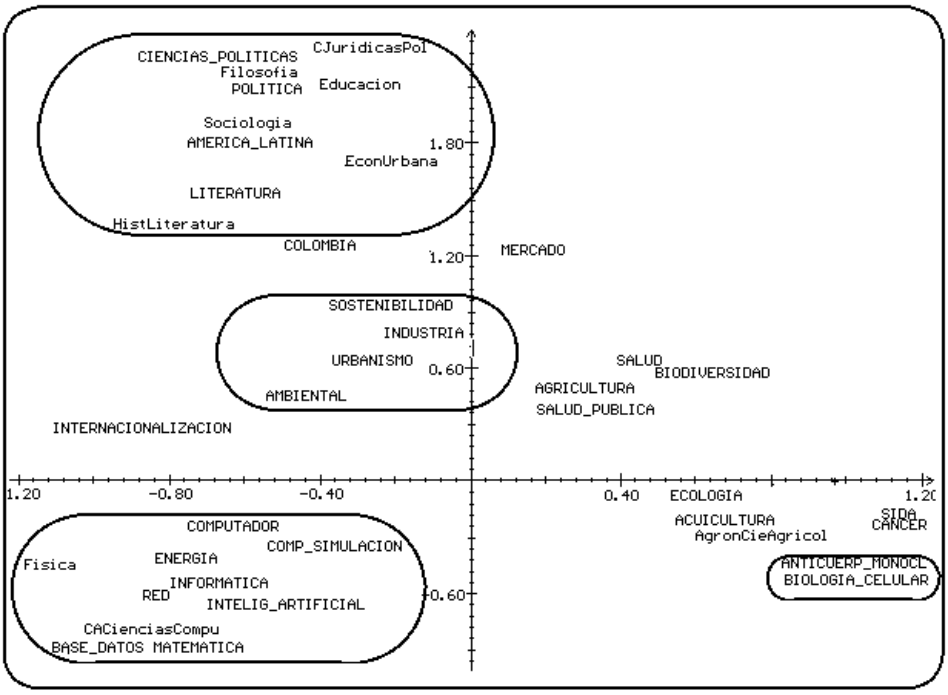


Graph 11 : Computer Sciences Cluster



Graph 12 : External relations of Physics

The method of simple correspondences used for the analysis of research activities (Graph 13) shows, however, the work fields in social and human sciences and the closeness between its research themes (upper left part of the graph), as well as a high correlation between the research subjects in the field of computer sciences. The presence of physics there shows a high relation with informatics techniques and may be interpreted as their use in research in progress. In any event, a more exact interpretation goes through the return to the data base and the information contained therein.



Graph 13. Research analysis by simple correspondences

Conclusions

1. The processes of constitution and consolidation of the Caldas Network represent an example of the construction of scientific cooperation from the potentialities of intellectuals emigrated from a developing country. The participation in a delocalized manner in the structuring of the national scientific capabilities based on the social relations of its members and the location of the accumulations present and distributed in the network permit the emergence of new solidarities in the field of science and technology and the performance of common projects between actors of an extended scientific community. The notions of social web, scientific tradition and of accumulation, which have been determinant for the understanding of the modalities of constitution and development of science and technology in industrialized countries find in the version of accumulation due to the actions, formations and activities of the members of a group of expatriate scientists a new version full of possibilities for the case of the developing countries.

2. The social and socio-technical dimensions established in the particular study of the Caldas Network and the constitution of an observatory of the scientific learning, accumulations and dynamics, represent a new model of a group of expatriate professionals, the scientific group of expatriates, a new conceptualization for the study and interpretation of international scientific migrations and permit to orient the preparation of national scientific policies which will consi-

der, for putting them into practice, the status and structuring in the field of the current Science and Technology and to make the decisions to mobilize, strengthen or construct the ties to be considered necessary to develop the national strategic scientific programs. Likewise, the institutions and the actors of research find in this notion of group of expatriate scientists the reference to establish in an autonomous manner the orientations, according to their interests, for their activities in the field of science and technology.

3. In a close relationship with the group of expatriate scientists a new modality of actor arises, the actor-network, who has multiple qualities : a) that of actor in the particular specialized knowledge ; b) that of politician and sociologist of science that mobilizes the local research networks to which he belongs and connects them to the national scientific community, organizes and orients the activities in his particular field and participates actively in the constitution of a national scientific and organizational infrastructure ; c) that of representative of an organization, which strengthens its negotiation capability with respect to other national and international organizations.

4. It permits to show the interests, differentiation and learning which are at the base of the solidarities generated and which are proper of every scientific enterprise. It also permits the qualification of a new type of actors capable of moving within multiple logic, and specially of politics, which is a critical need in order to be able to orient the decisions in the changing contemporaneous world of science and technology. Intangible results of the process of construction and consolidation are the learning incorporated by the actors, the acquisition of rules in effect and the implied regulations that permit to negotiate in better conditions their projects, collaborate and cooperate in joint enterprises with other actors, scientists and non-scientists.

5. The actors of a new type specified are in relation to the determinant interest at each time of their action. In effect, the actions that generate ties are different in the case of a science policy manager when motivated by a national strategic interest, of a representative from an institution who wants to know about the status of science or technology to be able to make decisions on promising research fronts, of a research director who wants to know the status of the problem to face a particular problem in his field, of a head of an industry who wants to know the situation in a specific technological domain in order to adopt strategies for his companies. Thus, the use of the prepared information is determined by the interests of the actors and orients the constitutions of the alliances and cooperation between the different types of actors.

6. Structured forms for the follow up of the dynamic of science and technology are necessary. In effect, it is not enough to know about the existence of expertise, on the forms of negotiation if the current capabilities and the possibilities of their mobilization are not known. They must have an available nature, which is achieved by the construction of a “calculation center”, a place in which all the basic information converges, is processed and is made available to the public. The group of expatriate scientists must then be fitted with a device for scientific and technological supervision, with a center of accumulation of information that must be prepared according to the interests and the needs of the various actors. To know who does what, when, where and with whom must be one of the functions of that central brain.

7. The understanding and conceptualization of this model of group of scientific expatriates helps to locate the conditions for its strengthening and development. The consideration of the socio-technical dimension and of the relations that exist between the actors through the elements of knowledge, the constitution of accumulations in specific areas considered necessary, the preparation of national scientific programs may be achieved as a result of political decisions rationally supported.

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[1] A total of 73 interviews were made to officers (4), technicians who participated in the creation of the electronic communication network R-Caldas (2), to active or associate members of the network (67) located in 16 countries, by the researchers of the project with headquarters in Paris, Washington, Vienna, Mexico and Colombia.

[2] This method considers keywords as indicators of the contents of documents and their simultaneous presence permits to evidence the structure of the relations between the referrals of those words, that is, between the themes. If we consider that the two documents are close because they have similar keywords, then two keywords that are together in a large number of documents are considered as close. In order to measure the intensity of associations between keywords (their closeness), between words i and j, for example, an equivalence index of Eij is used, which is the products from the probability that the word i would appear when word j appears by the probability that the word j would appear when the i word appears in the corpus documentary. Based on the measures of proximity between words, a hierarchical classification is made to group words close to each other, thus constituting the clusters. A cluster is thus made up by the internal keywords, by the internal relationships between them and by the external relationships between the words of the cluster and the words of the other clusters and takes the name of the keyword that has more internal relations. Two indicators permit to establish the structure of the clusters and of the network of relations that exists between the clusters and, in a more general way, between the network of associations present in the corpus documentary : the density (the mean value of the associations between the words that make up the cluster) and the centrality (the mean value of the external associations between the words that make it up and the words of other clusters). It is possible, then to construct a representation of the structure of associations in a plan defined by the axis of density and centrality (its strategic diagram) and establish the semantic contents of each cluster making possible, then, a local interpretation, given by the semantic contents of each cluster and global, by the relations between the different clusters of the contents of the corpus documentary.

[3] The nodes are associations that connect the members locally, initially in the cities where there is a relative density and, that in most cases take the name of the country where they are located. On occasions, there are several nodes in the same country and then they adopt the name of the city. autonomous in its administration.

[4] This assertion is based on the statements by those interviewed. The constitution of thematic lists connects specialists a priori and therefore it is difficult to follow its evolution from outside it. The follow up of communications in the Caldas Network list permitted, however, to determine some of the characteristics of the communication in the case of a non-specialized list, cf the communication to this Simposium by Granes, Meyer.

[5] On the dynamic in the preparation of projects, see the exposition to the Symposium by Morales, Granes and Meyer.

[6] This international survey was sent to all identified members. A total of 510 answers were received of which 453 were processed (in addition a sample was taken of 40 members who perform their activity in Colombia). Here questions 4-6 are considered : What benefits do you expect to obtain from the network ? and 4-7 : what contributions do you expect to make through the network ? The analysis was divided into two groups, the first one formed with the 453 answers coming from abroad, the second with those coming from within the country. For their processing, the statistical method of simple correspondences was used.

[7] This situation has been known as the construction of “calculation center” by Bruno Latour, a kind of central brain who accumulate data coming from multiple places and the organization and processing of which causes the emergence of the qualities and regularities present in the elements and which can only be found when all the data are considered in a unitary manner (Latour, 1989).

[8] (Meyer, Charum, Granés, Chatelin, 1995). It shows that the distribution of the publications according to areas is different specially in engineering, technological sciences and information sciences where 15 % are located (against only 3 % in the case of the interior community) and in Medicine and medical sciences which goes up to 45 % (36 % in the other case), in basic sciences it almost duplicates (9 % in the first case and 5 % in the second). Earth sciences go down to only 4 % in the case of the group of expatriate scientists, while it was 29 % for the interior community. If compared with education disciplines of the members of the network a certain evidence could be found of the option for certain formations, to the detriment of others and that these new emphasis would partially explain the results found in the publications.

[9] The capacity for interpretation of these results is conditioned upon the respective specific knowledge and then, the specialists are those who may establish the sense of the associations found. To this respect it is found that the interests of the actors are the ones that can take advantage of the information prepared.

Migraciones y construcción de la cooperación científica

Jorge Charum

Las migraciones científicas internacionales han sido objeto de una renovada atención en los últimos años. La reciente fractura de los sistemas de investigación de los países de Europa del Este es sólo uno de los elementos que ha contribuido a poner en la agenda de la sociología de la ciencia y la tecnología el tema de los desplazamientos más o menos permanentes fuera de sus fronteras nacionales de un gran número de científicos. El interés por comprender el relativo éxito mostrado por las nuevas políticas de repatriación de nacionales de los países del Sudeste asiático y sus implicaciones en su acelerado desarrollo industrial, el permanente interés por superar el nivel de la simple constatación del hecho mismo y avanzar en la comprensión y explicación del fenómeno migratorio, del Sur subdesarrollado al Norte industrializado, son otros elementos que han contribuido a este renovado interés. Por otra parte, más allá de la comprensión y la explicación de fenómeno se encuentra el interés por establecer políticas nacionales que permitan orientar los flujos de conocimientos, de competencias, de experiencias y de elementos -que son hoy propios de las dinámicas de la ciencia, de la creación del nuevo conocimiento y de las innovaciones- para el beneficio de una nación.

La noción de *brain drain,* que permitió enfrentar el estudio de estas migraciones, comenzó a mostrar sus límites explicativos cuando se intentó pasar de las formulaciones generales a los estudio más particulares y a la generación de políticas que contrarrestaran el fenómeno (Meyer, Charum, 1995). Estas se redujeron esencialmente a medidas compensatorias para los países de origen de las migraciones, incentivadas por organismos internacionales, o, cuando se trataba de políticas nacionales, en el otorgamiento de incentivos individuales para intentar asegurar el retorno de los científicos inmigrados a sus países de origen. Los resultados de estas acciones políticas nacionales no lograron obtener resultados apreciables.

Una mayor comprensión de las condiciones que hacen posible el desarrollo de la actividad científica y tecnológica sirvió de referencia para establecer condiciones positivas que hicieran posible invertir el sentido de la migración. La existencia o la construcción de estructuras científicas locales que permitieran recibir a científicos y tecnólogos formados y con experiencias investigativas y de trabajo en el exterior estuvo en la base de una nueva opción de capitalización de las capacidades nacionales expatriadas, llamada *brain gain,* y de la que los ejemplos más evidentes corresponden a países del Sudeste asiático : Corea del Sur, Taiwan, Hong Kong y Singapur.

El análisis de este modelo *del brain* gain en su versión más desarrollada permitió establecer a) las circunstancias particulares y específicas en que se dió un acelerado proceso de industrialización ; b) el sentido y las implicaciones que tuvieron la implantación de centros de investigación, vinculados a las necesidades de la industria y que hicieron posible desplegar una política de repatriación de investigadores e ingenieros formados que realizaban trabajos de investigación en los países de inmigración (Chaponnière, 1991). Sin embargo, las condiciones específicas que lo permitieron no encuentran una situación análoga en otros países del Sur, haciendo irreproducible para ellos esta versión del modelo del *brain gain* (Peemans, 1988)

La existencia de un tejido social que permite la circulación de problemas, investigadores e ingenieros, de financiaciones, de muestras, insumos e información, la elaboración de proyec-

tos conjuntos es, en general, el resultado de múltiples interacciones previas entre los actores de la investigación (los grupos de investigación) y los usuarios de los resultados. Este tejido, cuyo inicio en el caso de los países desarrollados puede extenderse a la Edad Media (Disco, Rip, van Der Meulen, 1992), ha sido resultado de largos desarrollos, de acumulaciones y de la construcción de normas implícitas y reglas explícitas que permiten orientar las relaciones de cooperación y la realización de proyectos comunes entre los diferentes actores que vinculan los polos científico y tecnológico y el sistema de las necesidades sociales.

Resultados recientes de la sociología de la ciencia y la tecnología han permitido comprender el papel jugado por estas largas acumulaciones. La caracterización de los procesos de formación de los científicos e ingenieros y de su inserción en los grupos de investigación y en las redes de producción de conocimientos han mostrado a) que la actividad científica es esencialmente colectiva y que moviliza una compleja organización técnico-organizativa que debe estar disponible para el despliegue de las posibilidades de creación de nuevos conocimientos y la producción de las innovaciones, b) que para esta misma producción y creación se ponen en juego los aprendizajes y los saberes implícitos integrados en una práctica colectiva prolongada y que, entonces, la inserción de un científico en nuevas tradiciones investigativas demanda el tiempo que permita esta socialización, lo que, entonces, no asegura la inmediata circulación de los científicos en tanto que tales, y c) que todo científico o ingeniero es en sí mismo una red, un actor-red, en donde se entrecruzan múltiples saberes, competencias y aptitudes, que encuentran su realización en la propia actividad y que, a su vez, esta actividad se despliega en el interior de una red de relaciones sociocognitivas en las que entran sus colegas y sus propias competencias, los intrumentos y el saber sobre ellos, los documentos y los resultados producidos por otros, las financiaciones y los recursos y los mensajes implícitos o explícitos que acompañan su atribución por parte de las entidades que los proveen.

Así, el problema de la migración de científicos, de su integración en nuevas redes investigativas locales, de su circulación internacional, de la creación de relaciones entre diferentes tradiciones de hacer ciencia o entre diferentes contextos geográficos debe abordarse teniendo en cuenta estas nuevas percepciones y evidencias.

Una nueva posibilidad de recuperación de las capacidades científicas nacionales comienza a delinearse a partir de experiencias y de proyectos de los propios países de origen de las migraciones, posibilidad que se ubica dentro de la opción del brain gain por cuanto tienden a recuperar las capacidades nacionales emigradas, pero sin tener como fin el primordial el regreso al país de quienes son los poseedores de ellas. Por el contrario, se considera que los científicos e ingenieros emigrados, por sus procesos de formación y de asimilación de las tradiciones científicas en los lugares donde ejercen su actividad, de incorporación de competencias experiencias y aprendizajes a través de su práctica investigativa o de trabajo pueden ser movilizados en sus lugares de residencia para colaborar y sostener el proyecto de hacer ciencia bajo las condiciones nacionales de su países de origen : carencia de largas acumulaciones en el campo de la ciencia, existencia de tradiciones científicas locales, en general no coincidentes con las formas normalizadas en los países centrales en el campo de la ciencia, escasez de recursos que permitan los esfuerzos investigativos continuados,... La posibilidad de capitalización de estas competencias exteriores a las fronteras nacionales ha dado lugar a diversos propuestas que tienen su origen en países del Sur.

Esta comunicación constituye un intento para ubicar potencialidades y límites de esta nueva opción de brain gain, la opción diáspora, que se concreta en el proyecto de construcción de una red de investigadores colombianos, la red Caldas, que para su realización busca articular las contribuciones de múltiples actores, científicos y no científicos, pertenecientes a la comunidad interior o a los grupos científicos e ingenieros emigrados, de las instituciones que orientan la política científica nacional, que realizan investigación, a los mismos grupos de investigación y a los usuarios de los logros alcanzados : las comunidades disciplinarias, el sistema de

enseñanza, las firmas. Se trata de concebir nuevas modalidades de cooperación y de colaboración con las comunidades de origen y con los grupos de investigación que permitan responder a las demandas de crear nuevos conocimientos y de innovaciones sin que las condiciones de acumulación y de tradición científica estén plenamente satisfechas.

El caso de la red Caldas

La red Caldas es un objeto social en construcción. Los resultados alcanzados permiten establecer su génesis, formación y consolidación. Estos momentos de su construcción y desarrollo se estudiarán a partir de las formulaciones hechas por quienes fueron sus actores determinantes. Para ello se realizaron entrevistas en diversos países por investigadores asociados al proyecto "El brain drain revisited a través del caso colombiano. Estudio de la red Caldas" [1]. La percepción que sobre la red tienen sus miembros se complementará con algunos de los resultados de la encuesta Redes Colombia. Esta primera parte permite captar la dimensión social de la red Caldas en un nivel microsociológico, el de la creación de nuevas estructuras cognitivas y sociales por la acción directa de y entre los actores, de los aprendizajes y las normalizaciones que estas acciones van progresivamente constituyendo y cuya sedimentación es una adquisición que deviene base para el desarrollo de las posteriores acciones. La caracterización de grupos diferenciados por sus posiciones frente a las oportes que cuentan hacer y los beneficios que piensan obtener por su participación en la red permitirá captar un segundo nivel de la dimensión social de la red.

La segunda parte busca establecer las potencialidades científicas y tecnológicas sobre las que puede apoyarse el paso a su constitución como red socio-técnica por la identificación de lo existente, por la ubicación de los dispositivos y de los elementos cognitivos movilizados y movilizables que se constituyen en la acumulación socio-técnica de la red, y que deviene un fondo común disponible para una comunidad de investigación. Para ello se utilizarán métodos cienciométricos e infométricos de análisis de publicaciones, de temáticas de investigación, de perfiles disciplinarios que permitan vincular lo que aparece en forma dispersa para hacer emerger las agregaciones y las estructuraciones internas de los diferentes elementos.

En la tercera parte, se extraerán algunas conclusiones y orientaciones para una realización de las expectativas : devenir un artefacto que permita orientar las decisiones políticas en el campo de la ciencia y la tecnología en un país en desarrollo que pretende avanzar en la producción autónoma de conocimientos y de innovaciones orientados por las necesidades nacionales.

La red Caldas como red social

La constitución y consolidación, aún en curso, de la red Caldas es un complejo proceso en el que convergen múltiples factores. En su inicio, marcada por el interés explícito por parte del Estado de internacionalizar la ciencia y la tecnología, de exponerla a las normas de calidad y de evaluación, el proyecto encuentra su apoyo en la voluntad y el interés de los intelectuales emigrados por trabajar por el país y en los grupos de investigación establecidos en Colombia por entrar en relaciones de trabajo con investigadores establecidos en el exterior. El llamado para que quienes participan en redes de investigación en el exterior lleguen a ser evaluadores de los proyectos nacionales presentados para obtener financiación, la formulacción por parte de Colciencias -la institución que tiene como encargo orientar las políticas científicas nacionales- de un nuevo compromiso que busca la articulación de una comunidad científica interior

con los investigadores emigrados que pueden, entonces, considerarse miembros activos para participar en la orientación de las políticas científica y ser reconocidos como miembros activos en el exterior de la comunidad científica nacional, creó las condiciones para empezar una movilización alrededor de lo que se puede considerar son elementos de un nuevo pacto social en el campo de la ciencia y la tecnología nacional.

A partir del análisis de setenta y tres entrevistas realizadas durante 1994 y 1995 es posible establecer las modalidades que tomaron los compromisos de los diferentes actores y las acciones que desplegaron en el proceso de constitución de la red. Las entrevistas estaban orientadas a establecer la percepción que se tenía de la propuesta de la red, el nivel de relación y de compromiso que despertaba el proyecto de su construcción, y las acciones que se veían necesarias y en las que eventualmente el entrevistado participaba o creía que se debían enfrentar. Se procedió a constituir una base de datos con estas entrevistas. Cada una de ellas se consideró un documento al que se le asignaron una serie de descriptores o palabras claves que permitían establecer las contribuciones del entrevistado a la formación y consolidación de la red, su posición frente a ella, las temáticas que les interesaban y los problemas que encontraban para su desarrollo en tanto que red de investigación. La copresencia de varias temáticas en los documentos se interpretó como asociaciones y relaciones entre ellas hechas por el entrevistado y consideradas por importantes por él.

Esto permitió, con base en el método de las palabras asociadas [2], establecer un mapa topográfico que representa los efectos de las actividades individuales pero cuyo efecto conjunto va determinando como cualidades y características generales de la red. Se muestran los tres *clusters* ubicados en las gráficas 1 a 3. El nombre asignado es el de la palabra clave interior que está más relacionada con las otras.

La construcción de la red (Gráfico 1)

La recepción y las expectativas generadas por el discurso oficial sobre la nuevas políticas nacionales de CyT pusieron en movimiento, inicialmente sin que se limitara la participación, a estudiantes avanzados, a investigadores con experiencia, a profesionales en ejercicio cuya relación con el país, en la mayoría de los casos, era más bien lejana o crítica.

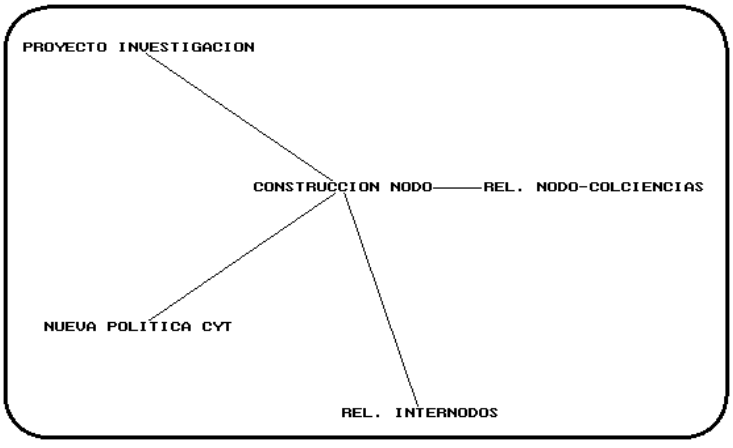


Gráfico 1. Construcción de la red

En el proceso de construcción de las asociaciones locales o nodos [3] uno de los primeros problemas que se debía solucionar era contar con una infraestructura de funcionamiento que asegurara la continuidad : sitios de reunión, medios técnicos para la comunicación por vía electrónica, la clarificación de las relaciones de los nodos con Colciencias -institución estatal de donde partió la iniciativa de vinculación a los nacionales emigrados-, y de los vínculos con otros nodos de la red. La construcción de los nodos es el resultado de la acción localizada de

actores sociales que conforman y definen el espacio propio, negocian las condiciones de su existencia y permanencia con las instituciones interesadas, establecen las modalidades de funcionamiento y administración internos. El discurso oficial es tomado en consideración para desplegar las actividades pero son las estrategias locales puestas en operación por los miembros las que articulan la acción complementaria de los diferentes actores. La cooperación de los servicios consulares locales, permitió incrementar la capacidad de convocatoria a los colombianos en el exterior y resolver problemas materiales inmediatos : lugares de reunión, acceso a medios de comunicación, diseminación de documentos internos.

En esta primera fase de construcción de la red se emprendió una reflexión sobre el sentido y la orientación que debía tener una red de investigadores en el exterior y el tipo de las relaciones que debían tenerse con el país. Desde el punto de vista de las finalidades de la red, se consideraba prioritario clarificar el tipo de proyectos de investigación que pueden establecerse con grupos colombianos, y sus orientaciones, lo que conduce a reflexionar sobre los vínculos que deben existir entre la investigación y la industria, entre ésta y la universidad y, en general con el polo científico, y sobre las acciones que permitirían un acercamiento entre todas ellas. Las discusiones muestran ya una más fina percepción del problema de la utilidad de la investigación, inducida claramente por los miembros de la diáspora cuya experiencia les ha mostrado que la actividad investigativa orientada es una práctica corriente en los países industrializados, lo que contrasta con la débil articulación de los polos científico y tecnológico que hay en Colombia.

Las relaciones internas y externas de la red (Gráfico 2)

La emergencia de la red estuvo sostenida por las asociaciones locales ya presentes entre los miembros colombianos, en particular en la red Colext que vinculaba a través de una lista de correo electrónico a muchos colombianos en el exterior. La diferenciación y la constitución de la red Caldas como una unidad con propia identidad, suscitó la primera fase de su constitución, discusiones sobre la realidad de las afirmaciones durante sobre la nueva política científica, su pertinencia, su orientación, su origen y el lugar allí podía ocupar una nueva asociación de intelectuales interesados en en el desarrollo de las capacidades científicas nacionales.

Las dinámicas de construcción de la red indujeron progresivamente diferenciaciones en su interior basadas en los niveles de formación, en las áreas de trabajo y en las condiciones en que desarrollaban sus actividades de estudio, de investigación o de trabajo los asociados. Una pri-

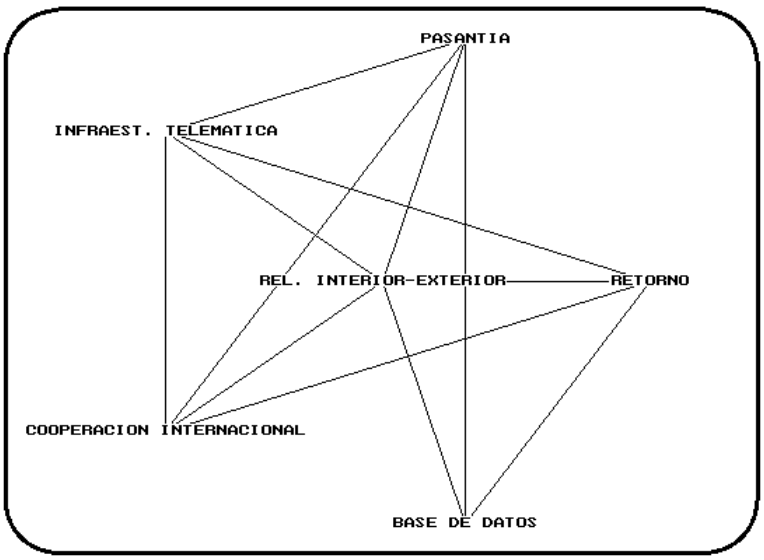


Gráfico 2. Relaciones internas y externas

mera diferenciación establece una jerarquía entre estudiantes avanzados e investigadores en ejercicio. Se consideraba que los primeros aún debían recorrer el camino que les permitiera insertarse en las redes investigativas locales y que sus expectativas actuales sobre los beneficios que les podía aportar la red estaban más vinculados a su futuro profesional que a su situación actual, en tanto que los segundos eran quienes, basados en el reconocimiento ganado y en las competencias poseidas, podían efectivamente lograr las cooperaciones y alcanzar resultados concretos : aportes desde su posición y competencia específicas, capacidad para proponer y realizar proyectos conjuntos, de negociar con organismos de su área de trabajo, de conseguir recursos y financiaciones, de orientar e inducir transformaciones en el sistema nacional de ciencia y tecnología. Podían, además, contribuir desde sus conocimientos específicos a la infraestructura técnica de la red. Así, por ejemplo, la comunicación por vía electrónica, de los miembros del nodo de París se realiza bajo la dirección de un especialista en el campo.

Una segunda diferenciación comenzó a delinearse entre las ciencias sociales y las humanidades, por un lado, y las ciencias duras y la tecnología, por el otro. Asociada a las densidades y las tradiciones de trabajo locales de cada una de estas agrupaciones, puso en evidencia una lucha por la definición de las orientaciones políticas de la red. La participación de los representantes de las ciencias duras aplicadas en tanto que especialistas en su campo estaba acompañada de consideraciones sobre las condiciones de desarrollo de la red y de su orientación práctica y en ésto penetraban en el campo de la práctica de la sociología y la política de la ciencia, dominio que es considerado propio de los científicos sociales. La preparación de diferentes proyectos concretos (en informática, física, medicina, por ejemplo), fueron especificando a los actores en el campo de la CyT, en tanto que la preparación de eventos en que se reflexionaba sobre las características de hacer ciencia, sobre el estado de la ciencia nacional, o sobre las modalidades contemporáneas de evaluación de la actividad científica eran consideradas actividades propias, aunque no exclusivas, de los científicos sociales. Esta diferenciación permite que se alcance una especificidad en las acciones desarrolladas debida a las áreas de trabajo -la movilización alrededor de proyectos concretos por parte de los primeros, de acciones más de tipo *forum* en los segundos- y tiene como posible consecuencia una complementariedad cuyos frutos aún están por verse.

Otros intentos de diferenciación según las áreas corresponden a la creación de listas del correo electrónico cuyos resultados aún no son concluyentes [4]. Por otra parte, las adhesiones alrededor de proyectos concretos van cerrando la participación calificada. Se percibe en ésto una característica de las redes : por una parte se construyen por las sucesivas adhesiones, de la solidaridades progresivamente encontradas en un número creciente de actores, pero estas adhesiones se realizan alrededor de temas o de proyectos concretos que cierran la participación de quienes no son calificados en el tema o el problema que se aborda. Los avances en estas diferenciaciones técnico-cognitivas específicas se pueden apreciar haciendo un seguimiento de los proyectos en curso [5].

Fuertemente asociado con la especificación de las relaciones entre la red y su exterior está la clarificación de las condiciones de reinserción en el tejido científico nacional de quienes cuentan regresar al país y de las formas concretas de las políticas de retorno. La disposición de una información estructurada deviene entonces crucial. La constitución de bases de datos que permitan establecer las dinámicas investigativas en el país, las acumulaciones en conocimientos y competencias presentes en la red, el perfil disciplinario y de las formaciones, los proyectos en curso de realización o ya finalizados es percibida como una de las condiciones que deben ser satisfechas rápidamente pues se considera que tanto las expectativas de retorno como la capacidad para buscar recursos a través de la cooperacción internacional, de constituir equipos que desde diferentes lugares y con competencias complementarias puedan establecer acuerdos para trabajar en proyectos específicos, debe estar apoyada en informaciones confiables, estructuradas y actualizadas. Se trata, entonces, de aprovechar las características de las redes para proponer las alian-

zas basadas en la complementaridad de las competencias disponibles, distribuidas en la red, especie de laboratorios de investigación virtuales que permiten poner en movimiento las contribuciones orientadas a objetivos específicos desde cualquier lugar del mundo donde se hallen.

La existencia de una información estructurada debe estar complementada con una capacidad incrementada de su acceso y de su circulación que permita fundamentar las demandas y acelerar la velocidad de las transacciones, de los intercambios, de las negociaciones. Esta consideración refleja una posición crítica sobre el manejo del tiempo de las negociaciones, de la toma de decisiones sobre las propuestas sometidas y la asignación de los recursos por parte de las instituciones nacionales y a los efectos negativos que tienen en las relaciones con quienes consideran que las decisiones deben ser seguidas de las acciones que de ellas se derivan. Comienzan asi a aparecer las distancias entre un discurso voluntarista sostenido por los operadores de la investigación nacionales y las demandas incrementadas de quienes, al aceptar las nuevas opciones que el discurso oficial abre, adquieren una mayor capacidad para proponer la realización de proyectos y no encuentran una rápida reacción a ellas.

Los aprendizajes y su incorporación en la red (Gráfico 3**)**

La constitución de los primeros nodos que alcanzan un relativo desarrollo generó una seria de aprendizajes que fueron movilizados para que la construcción y consolidación de otros. Se aceptaba que la red toma su carácter de tal si se pasa del nivel local, al nivel regional y, posteriormente, al mundial. Cada uno de los nodos es ya una red social, que se amplía cuando se crean otros nodos, se establecen y se precisan relaciones con ellos. La noción de red social se va precisando progresivamente y está orientada, sobre todo, por la idea de que su construcción es debida a la acción conjugada de los que en ella participan. Los medios técnicos son determinantes para ello, y, en especial, el acceso a una red de comunicación electrónica, la R-Caldas : la red Internet y el correo electrónico van a desempeñar un papel crucial en esta fase de organización y de intensa comunicación. Asi, la contrucción, la creación de una infraestructura de funcionamiento y de operación y la expansión son problemas percibidos como complementarios por los diferentes actores de la red.

Durante la fase de conformación de los nodos se prestó atención a precisar su posición frente a las instituciones colombianas. Se consideró además necesario tener, frente a las instituciones locales, regionales o con orientación más internacional, un status legal que constituyera a cada

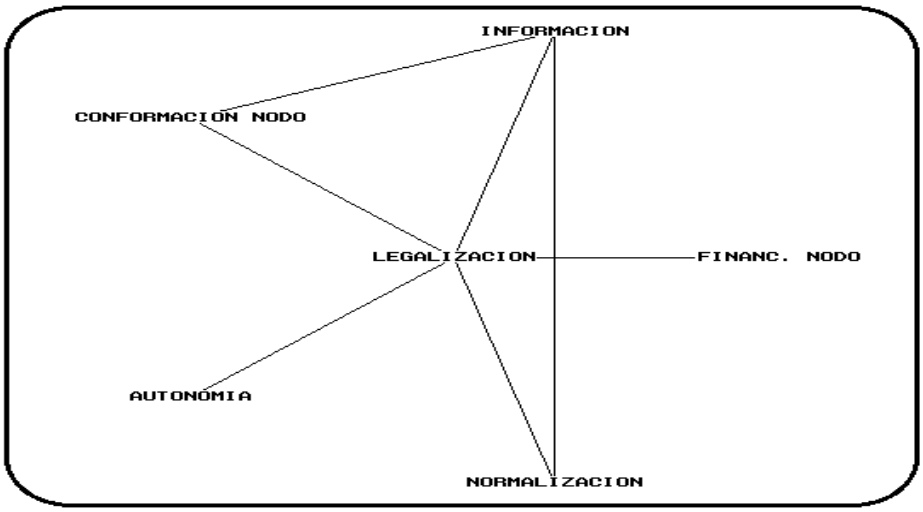


Gráfico 3. Aprendizajes y acumulación

uno de los nodos en una unidad local y a su conjunto en una unidad global a nombre de las cuales, fuera posible hablar y negociar. Esta *legalización*, dió lugar a una especificación de las funciones administrativas y a que aparecieran diferentes niveles de compromiso entre los miembros : los coordinadores de los nodos, desplegaron así una intensa actividad de difusión de los intereses de la red y de cooptación entre los miembros de la diáspora. Diferentes tipos de solidaridades para responder a las necesidades de administración, de consecución de recursos, de construcción de medios técnicos se fueron precisando. Así, por ejemplo, si la financiación básica de la infraestructura administrativa es demandada a Colciencias, ésta se ve complementada con recursos que provienen de otras fuentes : de los laboratorios a los que pertenecen los investigadores, de proyectos en curso, de fondos personales...

Vinculada a esta legalización se presenta la necesidad de *autonomía*. Autonomía frente a las instituciones nacionales, con las que se coincide en un proyecto común pero se tiende a asegurar a los propios actores la posibilidad de establecer las modalidades de su desarrollo y orientación. Se considera que las mismas orientaciones de la política científica nacional deben contar ahora con quienes han realizado trabajos en el área de la CyT; que los proyectos de investigación que se inscriban como realizaciones a partir de las posibilidades generadas por la red deben ser resultado de propuestas cuya orientación y desarrollo responden a los intereses de los propios actores de la investigación, aún si estas propuestas deben estar sujetas a evaluación y apoyadas con financiaciones y recursos. Progresivamente se va constituyendo la diferenciación entre actores de la investigación -los grupos que realizan la investigación- y operadores de la investigación- unidades éstas que fomentan, financian, organizan, controlan, evaluan la investigación, pero cuyo ámbito de operación no debe penetrar los procesos de realización de las actividades de investigación.

Esta autonomía asi concebida, la *especificación de las funciones* de los actores y de los operadores de la investigación, los aprendizajes derivados de los procesos de conformación y consolidación de las estructuras administrativas, la adquisición de un status jurídico que permite emprender, con un alto grado de representatividad, negociaciones y proponer proyectos son condiciones adquiridas por la red. Es esta normalización de las condiciones, integración de aprendizajes, definición de reglas, generación de normas implícitas la que ahora permite una movilización de los diversos actores para buscar asociaciones, proponer colaboraciones y proyectos conjuntos, obtener la cooperación de organismos nacionales e internacionales.

Las posiciones frente a la construcción de la red

El análisis del *corpus* de palabras claves derivadas de las entrevistas por el método estadístico de correspondencias simples (Gráfico 4) permitió establecer otras formas de agrupaciones que muestran diversas posiciones y actitudes de los entevistados frente al proyecto de construcción de la red. Una clara división se encuentra entre quienes, por una parte, tienden a adoptar una posición más reflexiva sobre las concepciones teóricas que deben orientar la construcción de la red o sobre las implicaciones políticas que tiene su construcción y quienes, por otra parte, adoptan una actitud más constructiva y pragmática. En esta primera posición los problemas de los vínculos entre la autonomía y la financiación, de definición de las relaciones entre los nodos o de la concepción de su estructuración interna son asumidos en un nivel teórico. Son características de ella las preguntas sobre el sentido de la constitución de una nueva forma de asociación propiciada por el Estado cuendo se tiene la experiencia de muchas promesas insatisfechas, o cuando es posible que esta asociación logre un reconocimiento internacional en el campo de la CyT y sin embargo la situación nacional de los derechos humanos continua siendo muy crítica.

La otra agrupación permite ubicar una actitud más activa que propende por la institucionalización de la red y la construcción de los elementos que permiten su constitución y operación. Así, la elaboración de las bases de datos -que permiten establecer las dinámicas de las publicaciones y de las investigaciones- la creación de listas que agrupen a los especialistas, la consolidación

de los nodos como unidades con capacidad de negociación, la circulación de los investigadores, la elaboración de propuestas de colaboración y de desarrollo de proyectos con los investigadores de la comunidad interior son el labores asumidas desde una actitud constructiva que los compromete activamente.

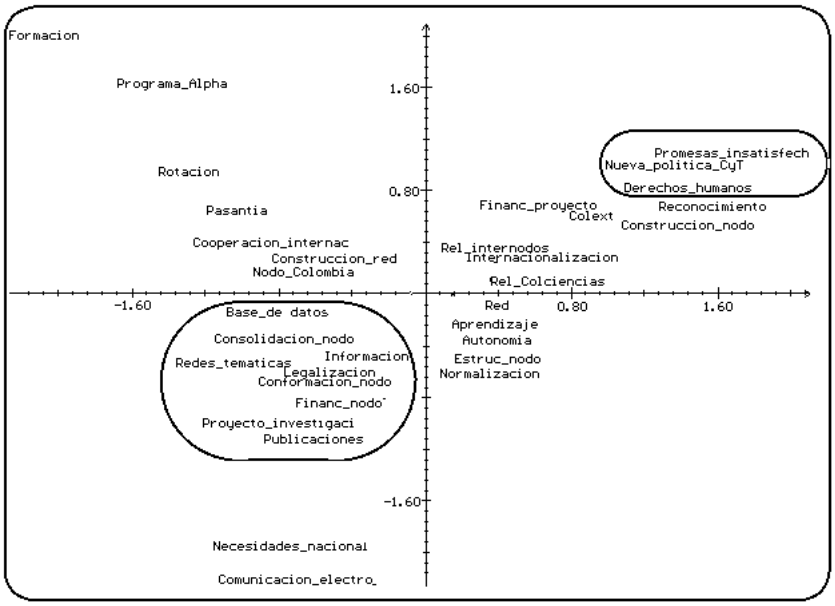


Gráfico 4. Entrevistas por análisis de correspondencias simples
Fuente : Encuesta Redes Colombia

Las múltiples posiciones frente a la red

Los análisis anteriores, basados en las entrevistas realizadas a miembros de la red que, en su gran mayoría, tenían en el momento de su realización un compromiso activo con ella, puede complementarse con resultados de la encuesta Redes Colombia, realizada durante 1994-1995 [6]. Los resultados obtenidos muestran que si se toma como referencia a las expectativas frente a la red, a los beneficios esperados y a los aportes que cuentan hacer a ella, es posible ubicar seis grupos dentro de los dos conjuntos de investigadores que respondieron a la encuesta, tres según las respuestas provenientes del exterior, tres para la muestra de 40 investigadores que trabajan en Colombia.

El primero grupo, cuyo peso en el conjunto de 453 respuestas es de 144, está representado por quienes no creen que se obtenga beneficio alguno por pertenecer a la red. No muestran ningún interés por establecer relaciones académicas o de trabajo, ya sea participando en cursos o asesorías, evaluando proyectos, recibiendo investigadores o contribuyendo a proveer medios de investigación. Una distancia frente al país y a sus necesidades los lleva a no querer visitarlo, a no desear tener vínculos con la comunidad emigrada. Tampoco creen que la red sea un medio que permita fortalecer su posición en el país de residencia, ganar un reconocimiento en Colombia por sus trabajos ni que a través de ella se le abran, en Colombia o en su lugar de residencia, nuevas perspectivas para su trabajo. Hay una gran probabilidad para que un representante de este grupo trabaje en Estados Unidos, tenga alli una posición estable de trabajo y que su edad esté comprendida entre 40 y 45 años de edad.

El segundo grupo, cuyo peso en el conjunto es de 149, está formado por quienes no se pronuncian sobre los beneficios que les puede aportar su pertenencia y no se expresan sobre los posibles aportes que harían a ella. Sin embargo, no es posible calificarlos de indiferentes por cuanto no comparten la idea de los que no quieren visitar al país, o que no están interesados por tener relaciones con los investigadores en el país, pues perciben que hay una apertura de posibilidades para realizar proyectos, para obtener financiación y para incidir en la política

científica. Entre quienes participan de esta posición hay gran probabilidad de encontrar a los estudiantes de doctorado lo que explicaría su posición vinculada a su incertidumbre sobre el cercano futuro.

Las características que definen al tercer grupo, (160 sobre 453), son mucho más afirmativas. Un interés por vincularse y fortalecer a la comunidad nacional en el exterior, por realizar intercambios con la comunidad académica interior, participando cuando sea posible en la realización de cursos, de asesorías, proponiendo proyectos conjuntos, evaluando proyectos, acogiendo a investigadores en su lugar de trabajo y poniendo a su disposición medios para realizar investigaciónes muestra su compromiso por fortalecer la comunidad interior. Quienes hacen parte de este grupo compartirían la idea de que hacer parte de la red les trae beneficios pues obtendrían reconocimiento por sus trabajos y resultados ya logrados y les permitiría hacer contribuciones al desarrollo del país. Frente a la política científica nacional uno de sus contribuciones sería poner su experiencia y conocimiento para contribuir a su orientación. Características propias de este grupo tienen una gran probabilidad de encontrarse entre quienes no trabajan, son colombianos en el exterior y menores de 29 años.

Estos resultados muestran que dentro del conjunto de la comunidad científica emigrada no todos devienen actores en la creación y consolidación de la red. En particular, quienes comparten las características del primer grupo tienen una posición pesimista o al menos lejana frente a un proyecto al que no pretenden contribuir activamente ni del que esperan obtener beneficios. Sólo dentro del tercer grupo se encuentran un nuevo tipo de actores que orienta y alimenta con sus contribuciones el desarrollo de los nodos en sus lugares de emigración y participan en la construcción de las características que progresivamente devienen acumulaciones dentro de la red y participan activamente en la creación de vínculos y desarrollo de trabajos cooperados con la comunidad interior.

El análisis de las cuarenta encuestas que provienen de la comunidad interior mostró igualmente la existencia de tres posiciones frente al proyecto de la red. Con pesos respectivos de 13, 17 y 10 entre los 40 encuestados estas agrupaciones están conformadas bajo las mismas posiciones que las de los tres grupos anteriores y sólo se encuentran diferencias en el tercer grupo del que hacen parte quienes quieren contribuir a la orientación de la política científica nacional, buscan una apertura al exterior a través de relaciones con la comunidad emigrada y están dispues-

Tabla 1. Subgrupos dentro de la red determinados a partir de las expectativas de beneficios y contribuciones

	Cluster 1 Peso : 144	**Cluster 2 Peso : 149**	**Cluster 3 Peso : 170**
Relaciones académicas o de trabajo	Desinterés	No sabe cuáles pueden llegar a constituirse	Cursos, asesorías, proyecto de investigación pasantías en su sitio de trabajo
Relaciones con el pais	Ninguna activa	Incertidumbre sobre su permanencia en el exterior o regreso al país	Contribución al desarrollo del país
Relaciones con la comunidad emigrada	Lejanas	Participación poco activa	Activas Propuesta de proyectos conjuntos Medios de investigación
Aportes	Ninguno	Inciertos. Posible contribución a la política cientifica	Orientación de la política cientifica . Proyectos conjuntos Evaluación proyectos
Beneficios esperados	Ninguno	Expectativas sobre beneficios, pero aúm no claramente definadas	Reconocimiento

Fuente : encuesta Redes Colombia

tos a recibir investigadores en sus sitios de trabajo. Así, están decididos a aportar a la red, pero, a diferencia de quienes se encuentran en el exterior, no esperan ningún beneficio de ella, excepto, quizás, el de ampliar sus contactos profesionales en el exterior y de concebir sus aportes como contribuciones al desarrollo del país. En la Tabla 1 se muestra la síntesis de las características de los subgrupos encontrados en la diáspora.

La movilización de la comunidad emigrada no está completamente asegurada y sólo cerca del 38 % (el porcentaje se reduce a 25 % en el caso de la muestra de la comunidad interior) de ellos participa activamente en las actividades de consolidación de los vínculos entre el exterior y el interior. Estos son los actores más dinámicos que han interiorizado las normas de colaboración y cooperación vigentes en la comunidad internacional y en las modalidades de negociación para obtener financiaciones, para desplazar a sus colaboradores o desplazarse ellos mismos entre instituciones que encuentran natural recibir y enviar técnicos, intercambiar productos y muestras, y que reacionan con rapidez y eficacia cuando aparecen las oportunidades de construir propuestas concretas de trabajos conjuntos. Las incertidumbres sobre el futuro posterior a la terminación de los estudios de doctorado podría explicar la posición de los indecisos del segundo grupo.

Características específicas y genéricas de la red Caldas

La directa participación de los investigadores en los nodos permitió encontrar algunas de las características que le dan su especificidad al proyecto de construcción de la red Caldas. Esta es una construcción híbrida, constituida por diversas contribuciones. Aparte de la decisiva iniciativa de Colciencias, variadas e interdependientes acciones, dentro y fuera de Colombia, han tenido una importancia decisiva. Había una clara voluntad política, una decisión central que provenía de un organismo público que se combinó con expectativas y esperas locales, a menudo individuales, que estaban presentes en el exterior. Los miembros de la red afirman con frecuencia que, aún antes de su creación, habían tratado de crear vínculos científicos e intelectuales entre ellos mismos y con Colombia. Atribuyeron los muchos fracasos de sus expectativas a la falta de reacción, decisión y consistencia de las políticas científicas del país. Así, para muchos de ellos estos deseos de ayudar se habían frustrado y se habían decepcionado por el fracaso de otras iniciativas anteriores. La red Caldas sale a la luz del día con este sentimiento ambivalente : por una parte una motivación espontánea de los intelectuales en el exterior para contribuir al desarrollo de su país de origen, pero de otra parte, la amargura y el pesimismo dejado por los previos fracasos. Estas son las paradójicas tensiones que trabajan en la construcción de la diáspora : una positiva identificación al país - un nacionalismo constructivo - pero, al mismo tiempo, una apreciación negativa de su capacidad de respuesta, una latente sospecha sobre los compromisos nacionales.

Desde su inicio, las dinámicas de la red Caldas han sido excéntricas. Aun si un agente central, Colciencias, propuso desde muy temprano un propósito colectivo y una organización general, los grupos locales que constituyen la diáspora han tenido siempre un desarrollo autónomo. Las orientaciones generales de los nodos pueden variar según las influencias que provienen de las características particulares del país en que se encuentra o de las propias historias de las asociaciones locales. Los nodos pueden entonces clasificarse según un eje con dos polos : los nodos “exo-céntricos” (orientados hacia el exterior) estarían en uno de los extremos, los “autocéntricos” (orientados hacia el interior) en el otro extremo. Bélgica estaría en el primero. Sus actividades y sus miembros están orientadas hacia una práctica internacional. Por ejemplo, realizaron un encuentro de todos los nodos europeos en Bruselas para discutir las políticas científicas colombianas y la cooperación con la Comunidad de la unión europea. Piensan que muchas de las actividades de la red podrían desarrollarse en el nivel europeo, más que en el nacional, por razones de economías de escala y por la existencia de una masa crítica que ellos no podrían alcanzar en un pequeño país como Bélgica. Para ellos, el nodo local sólo es una

parte del todo. Lo contrario sucede en la asociación del Reino Unido que no mantiene muchos contactos con otros nodos y desarrolla sus propias actividades de manera independiente, como un encuentro de biólogos colombianos en el país, por ejemplo.

Otros nodos tienen orientaciones más balanceadas y/o una configuración diferente. El nodo alemán, por ejemplo, adoptó una organización federal que prevalece en todo el país : es mucho más descentralizado, con grupos locales en las diferentes universidades regionales. El grupo de Nueva York ha tratado de expandirse y de fundar asociaciones en otras ciudades de Estados Unidos sin mayor éxito. Los nodos español y francés fueron a menudo bicéfalos con concentraciones en París y Madrid así como en Grenoble y Barcelona. Los miembros en Australia y Nueva Zelandia se encuentran dispersos, mientras que en Venezuela están masivamente localizado en una misma institución en Caracas...

La evolución de los nodos ha sido tan diversa como lo es su origen y su configuración. Sin embargo, se puede describir un patrón general. El nacimiento de la red generó una inflación de expectativas que estuvo acompañada por la conformación de un significativo número de nodos. La propaganda de Colciencias encontró una amplia recepción y generó una alta participación. La movilización inicial alcanzó, en muchos casos, niveles más allá de las expectativas que tenían los primeros actores. En una segunda fase, parte de la población de los nodos más antiguos entró en un estado de dudas y desilusiones, al considerar que la red no respondía a sus preocupaciones particulares. Algunos nodos nunca despegaron para expandirse más allá del núcleo de sus fundadores, En efecto, muchas personas mantienen una posición crítica con respecto al papel de Colciencias en este proceso. Dicen que este organismo no ha sido capaz de responder a las expectativas que despertó cuando los llamó a participar. Estas personas demandan un mayor soporte de Colciencias para las actividades y la vida de los nodos a través de la creación de una infraestructura (secretariados permanentes) para la asociación. Otros, por el contrario, son completamente refractarios a la idea de la participación de Colciencias, pues temen a lo que ellos consideran una burocracia ineficiente.

La red como red socio-técnica

Las acumulaciones de elementos cognitivos presentes en la red

Las acumulaciones en competencias y conocimientos presentes y con un relativo grado de disponibilidad permiten el despliegue de las acciones orientadas a la obtención de resultados en el campo de la ciencia y la tecnología. La noción de red debe entonces considerar, a la par que la dimensión social, la estructura interna de las capacidades científicas presentes en la red que se constituye en la referencia para orientar las acciones eficaces de los actores en la producción de nuevos conocimientos o en la creación de las innovaciones. La acción de lo actores en el dominio de la construcción de los nodos y, en general, de la red, la decisión de contribuir y las expectativas de beneficios permiten comprender esta dimensión social pero el sentido de red no se agota alli. La articulación entre las dimensiones social y cognitiva es una los aportes que, desde Kuhn, ha permitido conocer sobre las condiciones necesarias que hacen posible la creación en el campo científico. La teoría del actor-red prolonga la intuición kuhniana y muestra la complejidad de las asociaciones entre los actores humanos y no-humanos puestos en operación en las dinámicas de una red sociotécnica. Se trata de establecer el universo sociotécnico en que ella está llamada a operar. Emerge así la pregunta por los elementos con los que se puede contar o que pueden constituirse en la base para la actividad científica de los actores y en orientadores de su acción. Estos elementos, que tienen el carácter de intermediarios, son contribuciones a la red debidas al pasado de formación, de la producción pasada o de la actividad presente de los miembros. Permiten crear las condiciones, proponer y hacer posible las interrelaciones entre los actores, pero su disponibilidad sólo se percibe cuando se han agrupado o se han puesto en relación con los aportes de toda la colectividad.

La dimensión sociotécnica de la red Caldas puede entonces considerarse según diferentes temporalidades, como pasado en cuanto recoge las acumulaciones en la red debidas a la actividad previa de formación, de investigación o profesional de los actores, como presente en cuanto se trata de la actividad que actualmente es desplegada por sus miembros y como futuro, como campo de posibilidades creativas y espacio de la política. Es necesario, por otra parte, el diseño de dispositivos y de instrumentos de análisis que permitan hacer emerger todas las asociaciones conseguidas en base a las relaciones que se dan entre los elementos. En efecto, a diferencia de la dimensión social de la red en donde se trata de las relaciones directas entre actores aquí se trata de encontrar los elementos que sirven de intermediarios en las relaciones entre actores para la realización de sus intereses en el campo de la CyT.

Ahora bien, se considera que estos elementos son la base de estas acumulaciones que se presentan como saberes presentes pero distribuidos en la red, como competencias y formaciones que pueden estar geográficamente distantes y que sólo llegan a estar disponibles si se pueden ubicar sus características y dotarse de los medios para acceder a ellos. No se trata únicamente de hacer su inventario o descripción, aún si estos tienen su importancia, sino de *elaborar una información*, de producirla a partir de una información básica que permita mostrar las agregaciones y las relaciones implícitas o explícitas presentes entre los elementos de estas agregaciones y su disponibilidad. La noción de relación aquí ya no es más del tipo frente a frente, propia de los actores sociales en una red social, sino que, en un primer momento se da a través de elementos del conocimiento y establece su estructura y, en un segundo momento, hace posible e incluso orienta las relaciones entre los actores. La puesta en disponibilidad de estas elementos cognitivos es posible a través de dispositivos de recuperación, organización, tratamiento de los datos primarios y de su elaboración para producir un nuevo conocimiento. Ahora bien, esto sólo puede lograrse desde un *locus* privilegiado desde donde sea posible observar la totalidad de la red, sus acumulaciones y dinámicas y donde se procese la información básica que en forma permanente proviene de la red [7]. En efecto, la posición localizada de los actores sólo permite tener una percepción parcial de la totalidad de una red y de las acumulaciones distribuidas y es preciso, entonces, construir un “centro de cálculo”, especie de cerebro central que suministre una información actualizada, elaborada y especializada.

Nos interesamos aquí, entonces, en las modalidades concretas bajo las que se presenta estas acumulaciones. Para ello, en una primera fase, usaremos algunos indicadores cienciométricos. Inicialmente se ha establecido en el Gráfico 5 el perfil disciplinario de la red, que corresponde a las agrupaciones de las disciplinas presentes y que permite establecer las calificaciones y

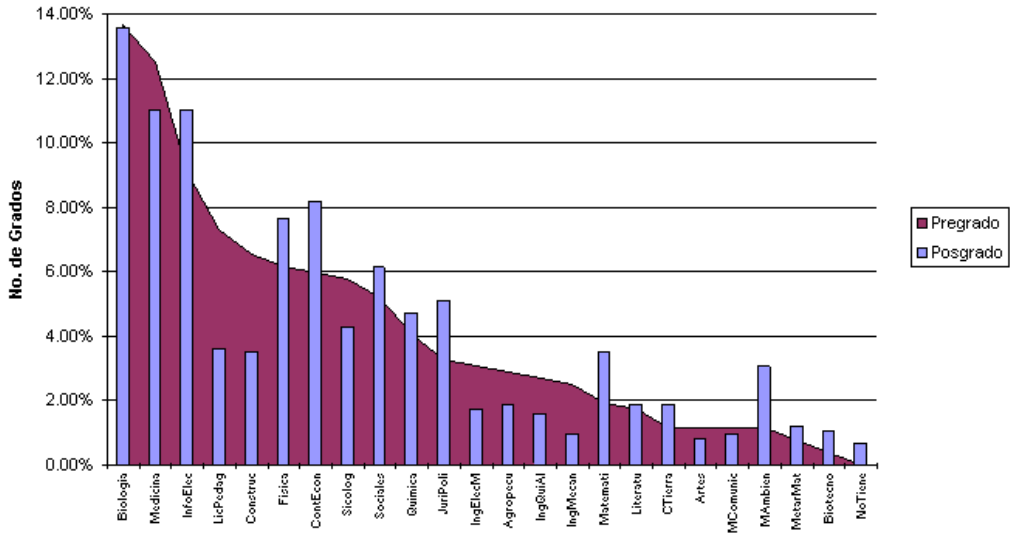


Gráfico 5. El perfil disciplinario en la red Caldas

competencias que han adquirido sus miembros. Por otra parte, si se considera que los resultados alcanzados en los procesos de investigación son objeto de publicaciones, podemos tomar como un indicador de la actividad desplegada por los investigadores los artículos científicos, los capítulos de libro, las ponencias e, incluso, los informes publicados que sólo se dirigen a un público restringido. Finalmente, para establecer las dinámicas se mostrarán las temáticas investigativas presentes y sus vinculaciones.

Las publicaciones como indicadores de la acumulación

Las publicaciones de los miembros permiten conocer quienes hacen qué, con quién y en dónde. En el momento de la realización de la encuesta Redes Colombia se solicitó la lista de las publicaciones. 380 de los encuestados enviaron la lista de sus publicaciones. Para realizar su análisis se construyó una muestra del 10 % del total considerando las distribuciones por disciplinas y por paises de origen de las publicación. A cada una de ellas se le asignaron palabras claves y se utilizaron, el método de las palabras claves-MPC y el análisis estadístico de correspondencias simples-MCS. En el Gráfico 6 se muestra el diagrama estratégico de las publicaciones donde se ubican las agrupaciones o clusters según los indicadores estructurales de densidad y centralidad. En el cuadrante superior izquierdo se encuentran los clusters que representan las temáticas con una alta densidad y una baja centralidad, es decir, que están relativamente desarrolladas y maduros pero los problemas sobre los que trabajan no tienen vínculos externos fuertes con otras temáticas. Es probable que se trate de campos que en su evolución continuen permaneciendo relativamente aislados. Este es el caso de Block copolymer y Measurement techniques in physiology, por ejemplo. En el cuadrante inferior derecho se encuentran los campos con vinculaciones externas (valor de centralidad mayor al promedio) aunque con una densidad baja.

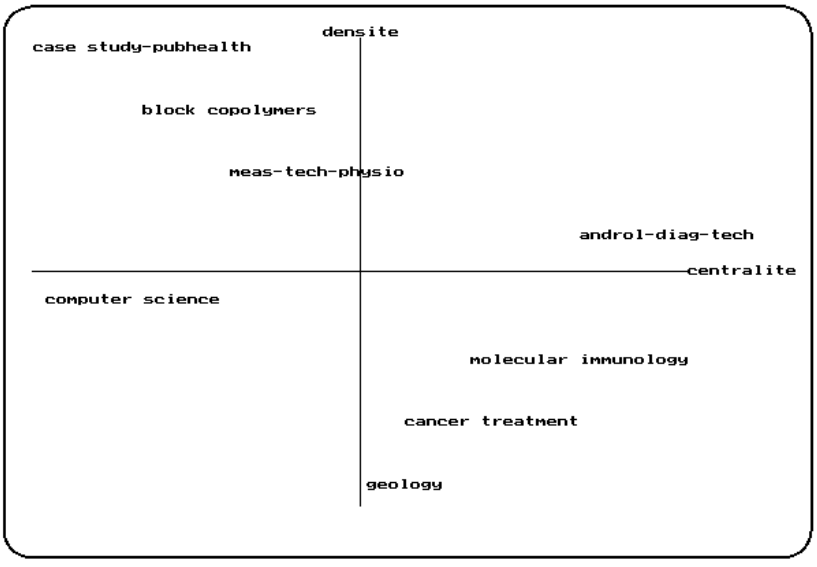


Gráfico 6. Diagrama estratégico publicaciones

Es previsible, entonces, que en su desarrollo atraigan a nuevos investigadores, y es probable que en su evolución sigan una trayectoria que las haga pasar al cuadrante superior derecho. Este es el caso de los temáticas representadas en los clusters *Molecular Immunology* o *Latin America*, por ejemplo. En los Gráficos 7 y 8 se muestran las subtemáticas representadas por las palabras claves que conforman dos *clusters* característicos : *Molecular Immunology* y *Block copolymers*. Por otra parte, se encuentra que, en general, hay muy escasos vínculos entre las temáticas en que publican los miembros de la red lo que señala que son campos de investigación independientes entre sí.

La comparación de estos resultados con los obtenidos en el análisis de las publicaciones de la comunidad interior y presentes en una base de datos internacional (Meyer, Charum, Granés, Chatelin, 1995) permite señalar algunas diferencias. Para el caso de la comunidad interior se encontró que hay muchas relaciones entre los diferentes *clusters* -lo que indica una mayor complementariedad entre los trabajos de investigación-, una opción por temas que están vinculados con necesidades nacionales, sobre todo en el caso de medicina y ciencias de la salud, de las ciencias de la tierra y en las ciencias naturales, lo que contrasta con la situación encontrada para el caso de las publicaciones de los miembros de la diáspora donde no hay una mayor asociación temática, lo que podría explicarse porque se trata de publicaciones de colombianos en el exterior que pertenecen a otras redes investigativas, con orientaciones e intereses diferentes. Se encuentra entonces más bien una complementariedad temática que se puede aprovechar para el propósito de articular el interior con el exterior alrededor de problemas comunes. Sin embargo, la pertenencia a redes investigativas distintas haría necesario desarrollar una política que busque crear los vínculos entre ellas.

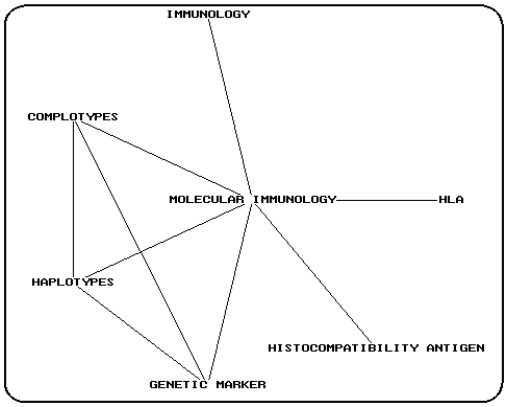


Gráfico 7. Molecular Immunology

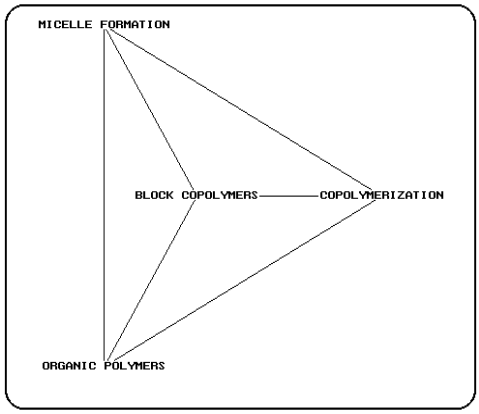


Gráfico 8. Block Copolymers

El mapa generado por el método de las correspondencias simples para el caso de las publicaciones en la diáspora permite extraer otras conclusiones. En este caso se encuentra la existencia de temáticas bien representadas (ubicadas en los límites exteriores del plano factorial) : ecología, nefrología, ciencias del comportamiento por ejemplo, que muestran actividades investigativas y de publicaciones relativamente independientes. Por el contrario, y en coincidencia con el análisis anterior, una cercanía entre diversas temáticas en Polímeros. Las ciencias de la computación encuentran vinculaciones con las redes de comunicaciones y el teleprocesamiento. Una interpretación más fina es posible ubicando los documentos y a sus autores [8], lo que es posible regresando a las bases de datos.

Las actividades investigativas como indicador de las dinámicas en la red

Un tercer indicador corresponde a las actividades investigativas de los miembros de la red. Este se estableció con base en la asignación, por parte de quienes respondieron a la encuesta, de palabras claves que describían su campo de investigación actual, lo que permitió, con base en el método de las palabras asociadas, establecer las agrupaciones temáticas de los campos de trabajo, su densidad y su centralidad. El diagrama estratégico de la investigación en la diáspora, Gráfico 9 muestra la multiplicidad de temáticas de investigación de los miembros de la diáspora, su distribución según su densidad y centralidad. En los Gráficos 10 y 11 se muestran los relaciones internas entre las subtemáticas que hacen parte de los *clusters* Inmunología y Ciencias de la computación y en el Gráfico 12 las relaciones exteriores que el *cluster* Ciencias de la computación tiene con otras temáticas, y lo que explica su posición en el cuadrante superior derecho. También en este cuadrante se encuentra representada la Física del estado sólido. Por el contrario, la representación de las ciencias sociales y humanas, como se aprecia por su posición en el diagrama estratégico, es mucho más débil.

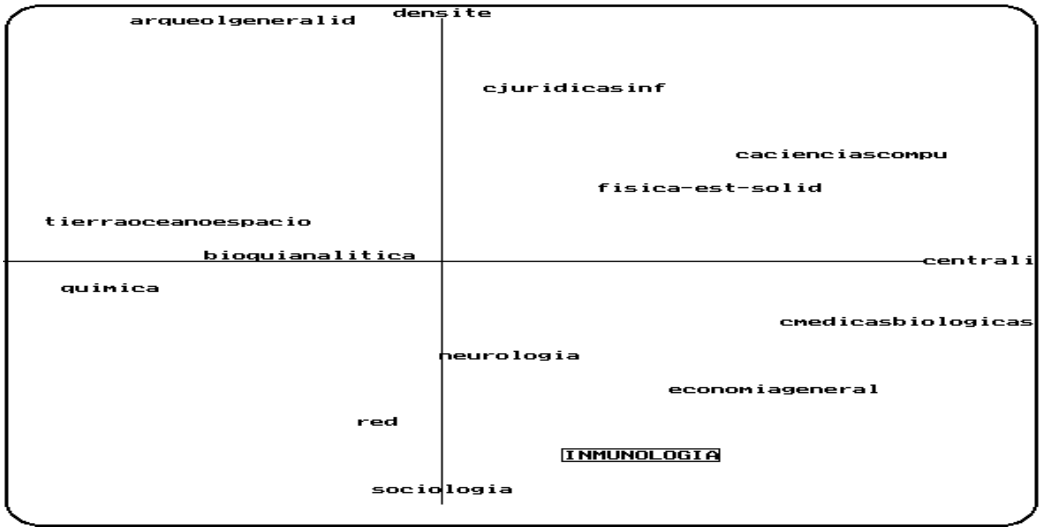


Gráfico 9. Diagrama estratégico de investigaciones

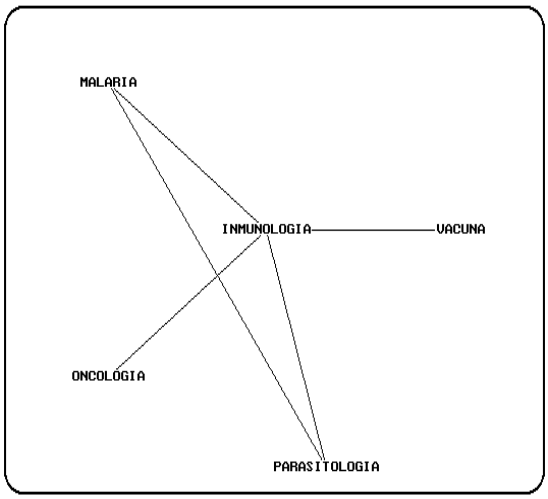


Gráfico 10. Cluster Inmunología

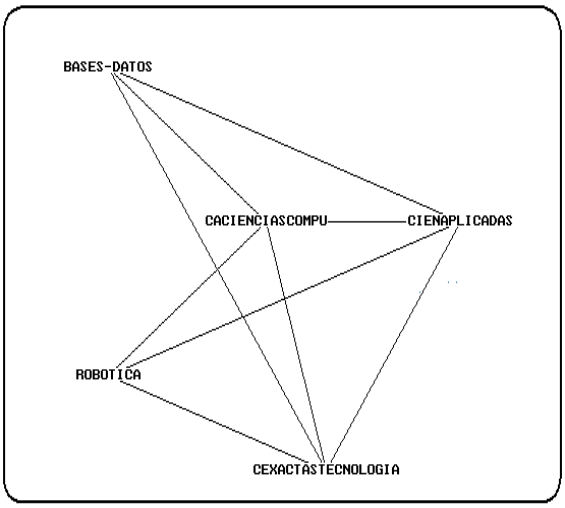


Gráfico 11. Ciencias de la computación

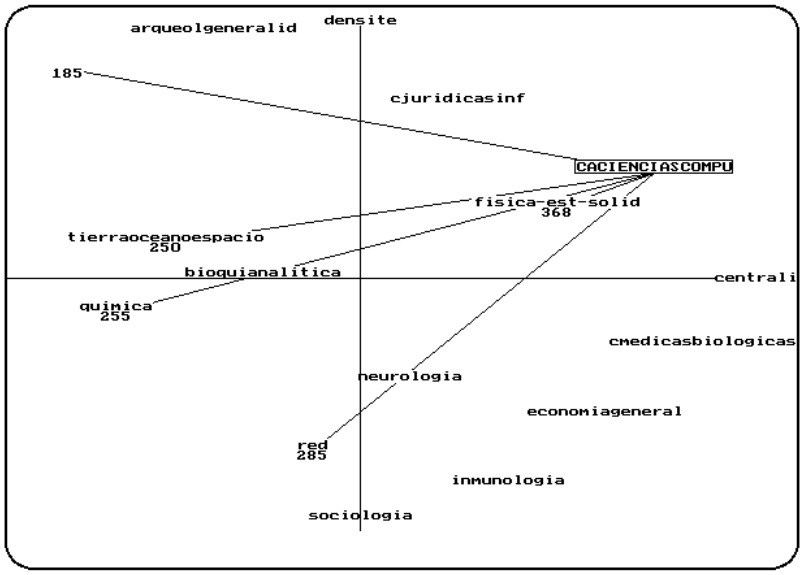


Gráfico 12. Relaciones externas del cluster ciencias de la computación

El método de las correspondencias simples utilizado para el análisis de las actividades investigativas (Gráfico 13) muestra, sin embargo, los campos de trabajo en las ciencias sociales y humanas y la cercanía entre las temáticas investigativas (parte superior derecha del gráfico) así como una alta correlación entre los temas de investigación en el campo de las ciencias de la computación. La presencia de la física allí muestra una alta relación con técnicas informáticas y puede interpretarse como la utilización de ellas en las investigaciones en curso. En cualquier caso, una interpretación más precisa pasa por el regreso a la base de datos y la información allí consignada.

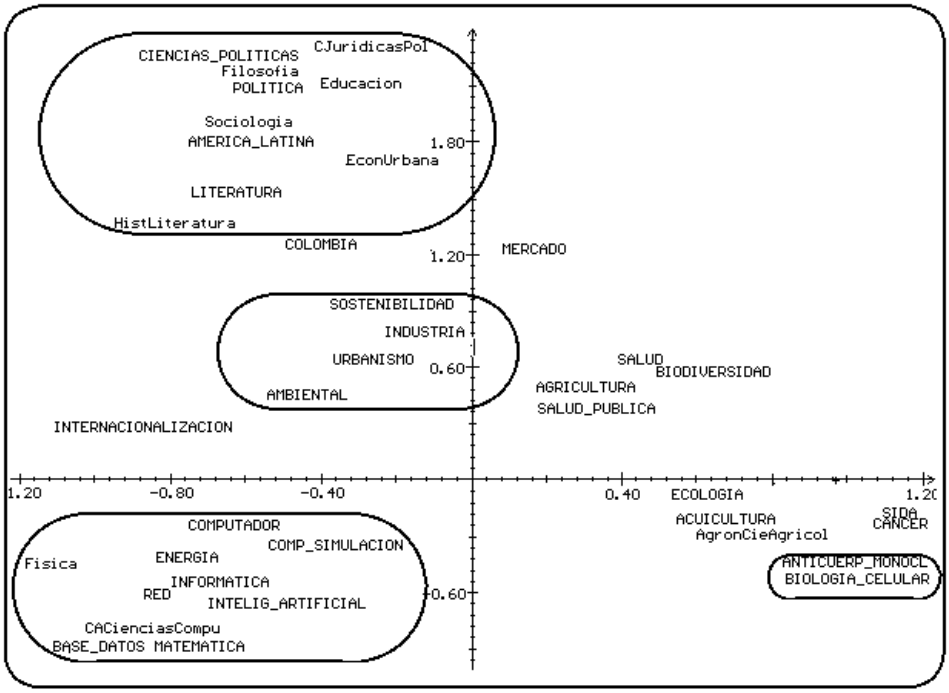


Gráfico 13. Correspondencias simples para las temáticas investigativas

Conclusiones

1. Los procesos de constitución y consolidación de la Red Caldas se constituyen en un ejemplo de la construcción de cooperación científica a partir de las potencialidades de los intelectuales emigrados de un país en desarrollo. La participación de manera deslocalizada en la estructuración de las capacidades científicas nacionales con base en las relaciones sociales de sus miembros y la ubicación de las acumulaciones presentes y distribuidas en la red permiten la emergencia de nuevas solidaridades en el campo de la ciencia y la tecnología y la realización de proyectos comunes entre actores de una comunidad científica ampliada. Las nociones de tejido social, de tradición científica y de acumulación, que han sido determinante para la comprensión de los modos de constitución y de desarrollo de la ciencia y la tecnología en los países industrializados encuentran en la versión de acumulación debida a las acciones, formaciones y actividades de la miembros de una diáspora científica una nueva versión plena de posibilidades para el caso de los países en desarrollo.

2. Las dimensiones social y sociotécnica establecidas en el estudio particular de la red Caldas y la constitución de un observatorio de los aprendizajes, las acumulaciones y las dinámicas científicas constituyen uno nuevo modelo de diáspora, la diáspora científica, una nueva conceptualización para el estudio y la interpretación de las migraciones científicas internacionales y permite orientar la elaboración de políticas científicas nacionales que consideren, para su puesta en práctica, el estado y la estructuración en el campo de la CyT actual y tomar las decisiones para movilizar, potenciar o construir los vínculos que se consideren necesarios para desarrollar los programas científicos estratégicos nacionales. Igualmente, las instituciones y los actores de la investigación encuentran en esta noción de diáspora científica la referencia para establecer autónomamente las orientaciones, según sus intereses, para sus actividades en el campo de la CyT.

3. En estrecha relación con la diáspora científica, emerge una nueva modalidad de actor, el actor-red, que posee cualidades múltiples : a) la de actor en el conocimiento especializado par-

ticular ; b) la de político y sociólogo de la ciencia que moviliza las redes investigativas locales a las que pertenece y las vincula a la comunidad científica nacional, organiza y orienta las actividades en su campo particular y participa activamente en la constitución de una infraestructura científica y organizativa nacional, c) la de representante de una organización, lo que potencia su capacidad de negociación frente a otros organismos nacionales e internacionales.

4. Permite mostrar los intereses, diferenciaciones y aprendizajes que están en la base de las solidaridades que se generan y son propias de toda empresa científica. Permite igualmente la calificación de un nuevo tipo de actores con capacidad de moverse dentro de múltiples lógicas, y, por sobre todo de la política, lo que es una imperiosa necesidad para poder orientar las decisiones en el mundo cambiante de la ciencia y la tecnología contemporáneo. Resultados intangibles del proceso de construcción y consolidación son los aprendizajes incorporados por los actores, la adquisición de las reglas vigentes y las normas implícitas que permiten negociar en mejores condiciones sus proyectos, colaborar y cooperar en empresas conjuntas con otros actores, científicos y no científicos.

5. Los actores de nuevo tipo que se especifican están en relación con el interés determinante en cada momento de su acción. En efecto, son diferentes las acciones generadoras de vínculos si se trata de un político de la ciencia cuando está movido por un interés estratégico nacional, de un representante de una institución que quiere conocer sobre el estado de la ciencia o la técnica para poder tomar decisiones sobre los frentes investigativos promisorios, de un director que investigación que quiere conocer el estado de problema para enfrentar un problema de su campo, de un jefe de industria que quiere conocer la situación en un dominio tecnológico específico con el fin de adoptar estrategias para su empresa. Así, la utilización de la información elaborada está determinada por los intereses de los actores y orienta la constitución de las alianzas y cooperaciones entre los diferentes tipos de actores.

6. Son necesarias formas estructuradas de seguimiento de las dinámicas de la ciencia y la tecnología. En efecto, no basta saber sobre la existencia de competencias, sobre las formas de negociación si no se conocen las capacidades presentes y las posibilidades de su movilización. Ellas deben tener el carácter de disponible, lo que se logra por la construcción de un “centro de cálculo”, lugar en el que convergen toda la información básica, se procesa y se pone a disposición pública. La diáspora debe entonces estar dotada de un artefacto de vigilancia científica y tecnológica, de un centro de acumulación de información que pueda ser elaborada según los intereses y las necesidades de los diversos actores. Conocer quien hace qué, cuando, dónde y con quien debe ser una de las funciones de ese cerebro central.

7. La comprensión y conceptualización de este modelo de diáspora científica ayuda a ubicar las condiciones para su potenciación y su desarrollo. La consideración de la dimensión sociotécnica y de las relaciones que se dan entre los actores a través los elementos del conocimiento, la constitución de acumulaciones en áreas específicas consideradas necesarias, la elaboración de programas científicos nacionales pueden alcanzarse como resultado de decisiones políticas fundamentadas racionalmente.

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[1] Se realizaron 73 entrevistas a funcionarios (4), a técnicos que participaron en la creación en la red de comunicación electrónica R-Caldas (2), a miembros activos o asociados a la red (67) ubicados en 16 países, por los investigadores del proyecto con sede en París, Washington, Viena, México y Colombia.

[2] Este método considera las palabras claves como indicadores del contenido de los documentos y su co-presencia permite poner en evidencia la estructura de las relaciones entre los referentes de esas palabras, es decir, entre las temáticas. Si se considera que dos documentos son cercanos porque tienen palabras claves similares, entonces dos palabras claves que se encuentran juntas en un gran número de documentos se consideran como cercanas. Para medir la intensidad de las asociaciones entre palabras claves (su cercanía), entre las palabras i y j, por ejemplo, se emplea un índice de equivalencia Eij, que es el producto de la probabilidad de que aparezca la palabra i cuando aparece la palabra j por la probabilidad de que aparezca la palabra j cuando aparece la palabra i en el corpus documental. Con base en las medidas de proximidad entre las palabras, se hace una clasificación jerárquica para agrupar las palabras cercanas unas a otras, constituyendo así los clusters. Un cluster está así constituido por las palabras claves internas, por las relaciones internas entre ellas y por las relaciones externas entre las palabras del cluster con palabras de los otros clusters y toma el nombre de la palabra clave que tiene màs relaciones internas. Dos indicadores permiten establecer la estructura de los clusters y de la red de relaciones que hay entre los clusters y, en forma más general, entre la red de asociaciones presentes en el corpus documental : la densidad (el valor medio de las asociaciones entre las palabras que constituyen un cluster) y la centralidad (el valor medio de las asociaciones externas entre las palabras que lo constituyen y las palabras de los otros cluster). Es posible, entonces, construir una representación de la estructura de las asociaciones en un plano definido por los ejes de densidad y centralidad, su digrama estratégico) y establecer el contenido semántico de cada uno de los cluster haciendo posible, entonces, una interpretación local, dado por el contenido semántico de cada uno de los clusters y global, por las relaciones entre los diferentes clusters del contenido del corpus documental.

[3] Los nodos son asociaciones que vinculan localmente a los miembros, inicialmente en las ciudades donde hay una relativa densidad y, que en la mayoria de los casos toman el nombre del país en donde se encuentran. En ocasiones, hay varios nodos en un mismo país y, entonces, adoptan el nombre de la ciudad. Cada uno de ellos es independiente y autónomo en su administración.

[4] Esta afirmación se basa en las formulaciones de los entrevistados. La constitución de listas temáticas vincula a priori a especialistas y en consecuencia es difícil seguir desde su exterior su evolución. El seguimiento de las comunicaciones en la lista Red Caldas permitió, sin embargo, precisar algunas de las características de la comunicación en el caso de una lista no especializada, cf la comunicación de Granés, Meyer "INTERNET y la globalización de la comunidad científica nacional. Un estudio empírico"

[5] Sobre las dinámicas en la elaboración de proyectos, véase la ponencia a este Simposio de Morales, Granés y Meyer y Morales "Las potencialidades y las limitaciones de la red Caldas de investigadores colombanos en el exterior. Un estudio de casos".

[6] Esta encuesta internacional fue enviada a todos los miembros identificados. Se recibieron 510 respuestas de las que se procesaron 453 (además se tomó una muestra de 40 de miembros que desarrollan su actividad en Colombia). Aqui se consideran las preguntas 4-6 : ¿qué beneficios espera usted obtener de la red ? y 4-7 : ¿qué aportes espera usted hacer a través de la red ?. Se dividió el análisis en dos grupos, el primero formado con las 453 respuestas provenientes del exterior, el segundo con las provenientes del interior. Para su procesamiento se utilizó el método estadístico de correspondencias simples.

7 Esta situación ha sido tematizada como la construcción de "centros de cálculo" por Bruno Latour, especie de cerebros centrales que acumulan los datos que provienen de múltiples lugares y cuya organización y procesamiento hace emerger las cualidades y regularidades presentes en los elementos y que sólo pueden encontrarse cuando todos los datos son considerados en forma unitaria (Latour, 1989).

[8] La capacidad de interpretación de estos resultados está condicionada por el conocimiento específico de que se trate y son, entonces, los especialistas los que pueden establecer el sentido de las asociaciones encontradas y tomar las decisiones basadas en la información elaborada contenida en estos mapas.

Collegial Networks and the Integration of Russian Immigrant Scientists in Israël

Nina Toren

Introduction

The phenomenon of scientists migrating from one country to another is worldwide, and studying the patterns and transformation of their collegial networks is of theoretical and practical interest. Collegial networks are patterned informal communication ties among colleagues of a professional group through which pertinent information is exchanged. Network linkages provide opportunities for, and constraints on, access to important and scarce resources necessary for scientific research, such as information, skills, and power. A basic tenet of the network perspective is that the structure or patterns of network ties shapes actors'attitudes and behavior ; for instance, it has been found that scientists who participate directly or indirectly in collegial networks are usually more productive than isolates.

Immigrant scientists usually encounter a situation in which their ties to peers in the country they left are severed or weakened and new associations in the country of destination have not yet been formed. The development of new ties is therefore extremely important. Indeed, the lack of personal and professional connections that would link them to the local scientific and professional communities, and establish access to resources necessary for their work, was one of the most difficult problems reported by scientists and engineers who immigrated to Israel from the Soviet Union in the mid-1970s (Toren 1984). At that time the Soviet Union was a relatively closed political, social, and scientific system in which individual scientists had very limited contacts with colleagues in Western centers of science. In the present study I describe and analyze the patterns of intellectual and professional ties of immigrant scientists who have recently immigrated to Israel from the former Soviet Union, in the second large wave of this migration, mainly in 1990/91.

Types of Collegial Networks

Two types of networks are distinguished and compared : the intellectual-influence network and the professional-support network.

a. The intellectual network, circle, or environment of a particular scientist is comprised of other scientists who influence his or her research intellectually. The resources exchanged through the ties connecting network members are mainly cognitive C ideas, scientific information, paradigms, models etc. The structural properties of the intellectual network such as, size, composition, density and range, influence and shape the scientist's research performance and guide his\her production of new knowledge.

b. The second type of network is the professional-support network. Respondents were asked

to name persons who contributed to their professional integration in Israel by helping, teaching, or training in professional matters and by providing connections to other scientists and institutions.

One-hundred and twenty-three scientists working in universities were interviewed. They mentioned a total of 430 individuals when asked to name persons whose ideas and research influenced their own scientific work (the intellectual influence network) ; of these only 8 persons were named more than once. A total of 448 persons were named by respondents when asked to name those who gave them professional help (the professional support network) ; here thirty-six persons were mentioned more than once.

The data show that the overlap among scientists'individual networks is negligible. This is partly due to the fact that we are not dealing with a bounded population (such as a prepared list of names) for which all ties linking persons to one another, directly or indirectly, are examined. Rather, the data here are egocentric, concerning the collegial networks surrounding each individual scientist and the connections among the members of these networks, according to her or his own report. There are almost no ties among the networks of the individual scientists in the included in the study.

I first compare the intellectual influence and professional support networks in terms of their structure. Structural properties of networks can be classified into two broad categories. One concerns the properties of *ties*, such as strength or intensity, multiplicity (the variety of resources that flow through them), homophily (the resemblance between ego and named alters), etc. The other category includes the characteristics of the *network itself*, such as size, range, composition, density, and the like.

Findings

Size and Range

The intellectual-influence and professional-support networks do not differ significantly regarding average size : the Means are B 3.49 and 3.64 respectively. Nevertheless, the intellectual influence network is of wider range (from 0 B 10 persons listed) and dispersion SD = 2.29 ; the respective values for the support network are from 1 B 9, and the standard deviation is smaller SD = 1.87. Put another way, the names of colleagues cited as influencers are widely scattered ; not even one can be regarded as a sociometric 'star' or leader of a research group, school, network, or clique of scientists.

Density

The density of a network is measured by the ratio of empirical ties to possible ties among the scientists named by a respondent as composing his/her professional-support network or intellectual-influence network. When everyone knows everyone else the density is 100 % (ratio = 1.0) ; when no one or only one name is mentioned, or ties are absent among network members, the density is 0. The findings show that the support network is more densely-knit than the influence network (the mean densities are. 76 for the support network, and. 53 for the intellectual influence network). In the professional support networks ties are absent (0 density) in 11 % of the cases, and 58 % were completely connected. By comparison, in the influence network zero density appeared in 26 %, and maximum density in 35 % of the networks.

Intensity

Regarding the professional-support network intensity or strength of ties is measured by frequency of personal meetings between ego and a colleague in the network. Overall, the results

show a high rate of personal contacts in the support network. The intensity of contact, like density, is mainly due to the fact that respondents and those cited in many cases work together in the same lab or department and interact face-to-face.

The strength of ties in the intellectual-influence network was measured by asking the respondent to rate the extent of influence of each named scientist. Over one-half of those named were rated as having `great' influence. Almost sixty percent of the intellectual influences have worked together with the scientists investigated in the same organization in the Soviet Union. This suggests that scientific influence which is supposed to have no boundaries was in this case concentrated not only nationally but also localized on the institutional level.

Homophily

Homophily is the degree of similarity between a scientist and the colleagues he/she names as intellectual influencers or professional supporters. Homophily can refer to scientific specialty, status, work organization, and nationality or country of origin.

Scientists comprising the intellectual-influence network are described as more similar to respondent in terms of scientific specialty and area of research than those in the professional-support network. Most were former teachers and superiors, while the professional-support network is mostly composed of colleagues. Intellectual influence entails more status discrepancy and hierarchical relationships, while assistance is received mainly from one's peers.

When dealing with immigrant scientists the degree of homophily of respondents' and network members' national origin is significant. Over one-half (52.5%) of scientists listed in the intellectual influence networks were from the former Soviet Union. In principle scientific ideas and knowledge may be exchanged across borders of any kind and tend to spread globally. We note, however, that in the present case intellectual influence was constrained by geo-political boundaries and was concentrated to a large extent within the former Soviet Union. A striking example of this closure is that 93 percent of the sampled scientists reported that they have never participated in a professional conference outside the USSR and the Eastern bloc before migrating to Israel.

The support networks are comprised of almost equal shares of immigrants from the former Soviet Union and local Israeli scientists (36.6% and 35% respectively). The Russian colleagues from whom professional support is obtained are former Soviet scientists who immigrated to Israel in the second half of the 1970's. These so called 'veteran immigrants' serve an important linking function for their 'new immigrant' colleagues by providing a bridge between them and the local scientific community, and in many cases also to scientists abroad.

Comparison of Properties and Contents of Networks and Ties

Structural Property	Intellectual Influence	Professional Support
Size	Same	Same
Range	Wider	Narrower
Density	Looser	Closer
Intensity	Mixed (weak and strong)	Stronger
Homophily:		
specialty	greater	smaller
status	different	similar
nationality	homogeneous	heterogeneous
Contents		
	Intellectual	Professional
	Cognitive	Technical
	Informational	Instrumental

Channels of Influence and Resources of Support

Up till now I compared the structure of intellectual-influence and professional-support networks of immigrant scientists ignoring the substance or contents of what is transmitted through these ties.

I. As noted above, what is transmitted through the intellectual collegial network ties is mainly of a cognitive nature C ideas, information, knowledge, paradigms, models, and the like. The main interest therefore, in reference to this type of network, has to do with the kind of channels through which these resources flow.

Respondents were asked to indicate for each name they mentioned as having influenced their research, the communication media through which this influence was exerted :

1. Publications (by the named scientist)
2. Preprints and prepublished materials
3. Conference presentations and public lectures
4. Telephone calls
5. Informal discussions
6. Letters
7. E-mail
8. Fax
9. Rumors

In science, as expected, the most frequently noted channel of influence is publications ; eighty-two percent said that intellectual resources are transmitted by reading network members' published work (1). Almost two-thirds noted that they had personal discussions with influencers (5). Less than thirty percent mentioned conference presentations as channels of influence (3).

I examined whether different channels of communication are structured in a certain way. For this purpose the correlations matrix of influence channels was analized using Smallest space Analysis (SSA). [Smallest space Analysis (SSA) is a nonmetric scaling multidimensional technique in which intercorrelations among all variables are made visually accessible by presenting them as points in a geometric map in which spatial closeness corresponds to high correlation].

The spatial display (Figure 1) shows that the points representing different types of influence channels are plotted in different regions. The region below the lower line includes two items C publications and conference presentations C which are the most impersonal and public channels of knowledge transmission. Moving up, the section between the lower and higher line includes less impersonal channels, such as preprints and prepublished materials, and information about a scientist's work obtained through a third party. The upper region shows the most personal and private kinds of channels in which there is direct contact between influencer and influencee, namely face-to-face conversations and discussions, telephone calls, and personal correspondence.

II. The professional-support network is composed mainly of local colleagues who helped and supported the new immigrant scientist professionally. Scientists were asked to name other scientists who assisted them by providing the following resources :

1. Familiarizing them with the university in which they work
2. Teaching them to use new research methods and equipment
3. Finding a job or recommending them to potential employers
4. Helping in writing research proposals
5. Creating contacts to local Israeli scientists
6. Creating contacts to scientists outside Israel

7. Sending them to professional training courses
8. Helping to get their research results published.

The different items of professional support fall into two regions. The left side of the map includes instrumental-technical support items C help in writing a research proposal, teaching how to use equipment, training or upgrading courses etc. The other category of resources is depicted in the diagram's right side and pertains to relational aspects (`ties to ties'), such as helping find a job, establishing contacts with other scientists in Israel and abroad, connections with academic institutions, etc. In the case of immigrant scientists, besides instrumental and technical support, help in building networks of associations and establishing ties are a major resource for their integration into the local and international scientific community.

Summary

To summarize, intellectual influence and professional support networks as delineated by the scientists studied, differ in terms of their structural attributes. The intellectual collegial network constitutes a fragmented, low-density, long distance, and mixed high and low intensity network ; whereas the links in the professional support network are more concentrated, densely knit, close and intense. The substance and resources that are exchanged through these different networks correspond to this classification : what flows through ties of the intellectual influence network is mainly information and ideas, while the resources transmitted via the professional support network are much more instrumental, material and down to earth.
From a practical point of view it seems that Russian immigrant scientists, at least those currently employed in universities, receive professional assistance from rather tightly- knit networks of local Israeli colleagues (including veteran Russians) with whom they work and interact. The development of more far reaching intellectual collegial ties, which are vital in science, is more problematic. In general, the range of these networks before migration was limited to other scientists within the former USSR with very little cross-national contacts. Since scientific research in Israel is strongly oriented toward Western centers of science, Russian immigrant scientists will have to pursue intellectual connections with new colleagues in Israel and the West. In this respect local Israeli and veteran Russian scientists perform an important bridging function to other national and international communities of science. In the long run intellectual influence ties, their density and diversification, will become more important because they are the main channels through which scientific information is acquired and exchanged. Furthermore, immigrant scientists will learn new techniques and norms of doing science, and thereby become less dependent on professional assistance from colleagues in their immediate environment.

Brain Drain, Brain Gain and Scientific Communities: Indian Experience in the Field of Biotechnology

Venni V. Krishna

Introduction

Ever since the developing countries embarked on building modern scientific and technical structures, the problems associated with the process of brain drain became a stumbling block in building local-national S & T capacities for development in many emerging fields of research. Beyond the material and economic factors, on which studies have thrown ample light, there are sociological factors related to the social organization of science and technology which influence the migration of scientists from their countries. Training scientists in high tech and frontier fields of research without the existence of a certain viable number of research groups or specialist communities (in a sociological sense of the term), in the first instance, results in the migration to places which offer a better professional climate and which have created a demand for intellectual capacities. As one of the leading Indian chemical scientists, Masheikar (1984) observed, “the brains go where the brains are. Brain goes where there is a challenge and brain goes where intellectual achievements are valued”. The status of scientific communities and the professionalisation of science and technology fields of research is closely associated with the phenomena of brain drain and brain gain - the features being the two faces of the same “ coin ”. In other words, the promotion and growth of specialist communities with a viable number of research and development groups in a given area of science not only checks the process of brain drain but given the professional climate and an intellectual context generates the potential to attract the return migration of scientists back into their home countries. This is the hypothesis which is explored in this paper taking the field of biotechnology as an empirical case study.

Beyond the central focus of the concept of scientific communities and professionalisation in understanding the problem of brain drain, the perspective of “ networks ” is also used to map the structure of biotechnology field for its research-academia-industry-market connectivities. It is seen that this network emerged in three stages over a period of two decades. As else where in the world the emergence of biotechnology industry in India is seen to have created a demand for absorption of scientific and technical personnel. Even here it was seen that the part played by the science -research- academia nexus and the process of professionalisation remained central in the formation of the network. The paper is structured into the following sections :

- Institutional background to biotechnology prior to 1980
- Emergence of biotechnology after 1980 : Government support, university courses, information networks, funding and the creation of Department of Biotechnology
- Growth of post graduates and Ph. Ds
- Features of professionalisation and Scientific Communities
- Towards biotechnology network
- Concluding remarks

Institutional background to biotechnology prior to 1980

In an effort to trace the institutional growth of biotechnology during the last decade, it is necessary to understand the status of modern biology. As some reviews suggest, the development of biotechnology has been closely related to that of basic modern biology, which includes disciplines such as biochemistry, molecular biology, cell biology, immunology, genetics and, virology, many of which envelop substantially with others (see Bhargava and Chakrabarti 1991 : 515). Even though India witnessed considerable growth of professional research groups and institutional specialities in these areas of modern biology during the period late 1960s and late 1970s, biotechnology as a specialized field of activity with recognizable community did not emerge till the early 1980s (see Padmanabhan 1991 : 510, 51 1). The nuclei for the development of modern biology in the pre-1980 era can be located in about eight research centres at Bose Research Institute, Calcutta (led by D. Burma) ; Christian Medical College, Vellore (led by B. Bachawat and A.N.Radha Krishna) ; Tata Institute of Fundamental Research, Bombay (led by Obaid Siddiqui) ; Indian Institute of Chemical Technology, Hyderabad (led by P.M.Bhargava) ; All India Institute of Medical Sciences, New Delhi (led by G.P. Talwar) ; Indian Institute of Science, Bangalore (led by G.N.Ramachandran and P.S.Sarma) ; National Chemical Laboratory, Poona (led by M. Damodaran and V. Jagannathan) ; and Department of Applied Chemistry at Calcutta University, Calcutta (led by B.C.Guha) [1].

From the mid 1970s, various post graduate departments in modern biology were established in the universities including the medical colleges and agricultural universities. Two professional societies which strengthened the modern biology research groups from the 1960s are - the Society of Biological Chemists of India (established in 1931) and the Guha Research Conferences (established in 1961). Between 1960 and 1980 various journals were launched in the areas related to modern biology as shown in table l :
The establishment of a specialised national laboratory - Centre for Cellular and Molecular Biology (CCMB) in 1977 in Hyderabad under CSIR followed by the creation of National Institute of Immunology at New Delhi ; and Institute of Microbial Technology at Chandigarh were significant milestones for the discipline of modern biology. In many ways these institutes catalysed the institutional growth of molecular biology and biotechnology from the latel970s.

With the moderate growth of modern biological research groups in over a dozen institutions, the elite biologists became receptive to institutionalize the field of biotechnology, which made revolutionary strides by that time in the west. As one of the leading biologist observed :

Some of us did recognize that we were going soon to start living in the age of biotechnology as far back as the early seventies by which time the technique of tissue culture was well establi-

Table 1. Some of the main Indian journals in modern biological launched after 1960

Year	Journals
1961	Indian Journal of Microbiology
1963	Journal of Experimental Biólogo
1966	Journal of Cytology and Genetics
1968	Indian Biologist
1971	Indian Journal of Mycology and Plant Pathology
1972	Journal of Agriculture Biology
1975	Advances in Pollen and Spore Research
1977	Biological Memoirs
1978	Cell and Chromosome Research
1979	Journal of Biosciences
1979	Journal of Environmental Biology
1985	Annals of Biology
1986	Journal of Microbial Biotechnology
1986	Indian Journal of Applied and Pure

shed and it was possible to transfer new (but only homologous) genetic information into micro-organisms through conjugation, transduction, transformation and later, transfection. Those who were guiding the destiny of science in the country around that time were fortunately receptive to these ideas.... (See Bhargava and Chakrabarty 1991 : 515)

Our survey of 13 research groups for the period before 1980 shows, that more than 60 % of the leading scientists working in the areas related to modern biology obtained doctoral and post-doctoral training in the west or spent between 3-5 years abroad before taking up positions in India. International connectivity for modern biology with labs and elite in the west was very strong during this period. Even though most of the Indian universities and research institutions offered doctoral research programs in the biological sciences, specialities *related to* biotechnology lacked higher professional base in India during the 1960s (jpto mid 1970s). In other words, there was a considerable professional gap between India and the west which made the west a natural destination to the highly motivated professionals. As the data of Gulati (1990 : 200) shows, between 1965 and 1979 an average of 91 doctorates were awarded every year to Indian graduates in life sciences from the U S universities. This figure declined to 42 doctorates every year after 1980. Beyond the immigration policies, one explanation for the decline of this trend in the number is related to the marked growth of modern biology fields in Indian institutions. Among these, the fields of biotechnology and molecular biology witnessed considerable institutional growth.

The emergence of a recognizable community and institutional growth of modern biology specialities during the late 1960s and 1970s enabled the promotion of biotechnology and molecular biology after the early 1980s. What is the institutional growth scenario of biotechnology field after 1980 ? How many research groups and specialized institutions were established during this period ? What was the role of government in fostering this field of research including higher education ? What is the relationship between the professional growth of the field and the problem of brain drain or gain ? These are some of the issues which will be addressed in the upcoming sections.

Emergence of biotechnology after 1980: Government support

As in the case of many developing countries, the state support to science and undertaking of research in publicly funded institutions has been the dominant feature of science and technology growth in India in the post-independence period. Biotechnology and its related areas of research has been no exception to this general historical trend after 1980. Given the considerable growth of modern biological research base, as seen in the preceding section, the demand for the promotion of biotechnology received considerable support from the biological community from the late 1970s. In response to this growing demand for this promising area of research, the Prime Minister announced the government's decision create a National Biotechnology Board (NBTB) on 3 January 1982 at the 68th Annual Session of the Indian Science Congress held at Mysore. This was indeed a significant milestone in the formation of a biotechnology policy in the country in comparison to other policies relating to nuclear, space, electronics, telecommunications, agriculture, ocean development, energy etc. This Board was constituted by a high powered committee chaired by the head of the Science Advisory Committee to the Cabinet. Other members of the Board were at that time drawn from the Departments of Science and Technology, agriculture, atomic energy, CSIR, ICMR, University

Grants Commission and the Finance Ministry. The Board had the services of a full-time advisor who was also its Member-Secretary. As the review of Swaminathan (1986 : 300) indicates, the mandate of the newly created biotechnology Board covered the entire gamut of activities ranging from the financial support, support to higher educational training and research, coordination with other relevant science agencies and institutions, procurement of chemicals and equipment for the professionalisation of the field, training of human resources, exchange of experts with foreign laboratories, support to workshops and international meetings etc.

Realizing the revolutionary growth of the field in the west and the industrial potential to generate wealth, the elite biological community soon realized that a Board is an inadequate structure to usher the potential of this field in the country. Without wasting much time the government responded by reconstituting the NBTB in 1986 as a separate Department of Biotechnology with a status at par with other science and technology related Departments as mentioned earlier. This was the second milestone in the evolution of a biotechnology policy in the country. As Ramachandran (1991 : 518), the first head of this newly created Department, observed :

The two areas on which the new Department of Biotechnology (DBT) initially concentrated, in continuation of the earlier emphasis by NBTB, were manpower development and creation and strengthening of infrastructural facilities. The objective was to build up trained manpower and general competence in the field of biotechnology.

During the early 1980s, the overall expenditure on biotechnology research, development and training accounted for about 100 million rupees. During the mid 1980s this expenditure increased to 220 million rupees and from 1986-87 the expenditure further increased to about 350 million rupees per year. The current budget of DBT alone is about 700 million rupees per year. However, besides this figure, the field also attracts funding from other larger science agencies in agriculture, industrial research, medical, University Grants Commission and the Science and Engineering Research Council of the Department of Science and Technology which increases the total funding to the field at least two times the current budget of DBT per year.

In an effort to keep the scientists abreast of the advanced research and development in the fields of modern biology and related fields, the DBT has sponsored Distributed Information Centers (DICs) in 9 universities and R & D laboratories as shown in the Table 2. The provided through DICs to access the international data bases. In addition, fourteen user centres have been created in different parts of the country with access mechanism to make the information available at universities, laboratories and manufacturing institutions.

From the beginning the DBT laid high emphasis in sponsoring higher educational training in the area of biotechnology for the generation of adequate R & D human resources. From the early 1980s, DBT made available funds for institutionalising M. Sc/Ph. D and post-doctoral

Table 2. Information and Data Base Centres in biotechnology

Institution	Specialisation(s) in DICs
Indian Institute of Science	Genetic engineering
Madurai Kamraj University	-do-
Bose Institute	-do-
Jawaharial Nehru University	-do-
Poona University	Animal Cell Culture & Virology
Indian Agriculture University	Plant Tissue Culture; Photosynthesis; and Plant Molecular Biology
Centre for Cellular & Molecular Biology	Oncogenes: Reproduction Physiology; Cell Transformations; Nucleic Acid and Protein Sequences
National Institute of Immunology	Immunology
Institute of Microbial Technology	Enzyme Engineering

training in 28 selected universities and research institutions. As the report on the activities of DBT (see Ramachandran 1991 : 519) indicates, “ selection (of institutions for support) was based on the strength of existing infrastructure and resource personnel, ongoing research programmes, proximity to other institutions working in the related areas ”. In these selected universities, the DBT funded new faculty positions (about 3 to 4 positions on an average per university) during the last decade. In addition to the regular higher educational and research courses, DBT sponsored short-term training programmes in high-tech specialised areas, technical training programmes for industrial R & D personnel and diploma courses to train the technicians required for the biotechnology industry. According to one estimate, about 1800 personnel were trained during the last decade in the latter type of training courses.

Growth of post-graduates and doctorates in biotechnology

190 universities in India produced a substantial number of post-graduates and doctorates in the fields *related* to biotechnology during the last decade [2]. To have an idea for the recent period, India produced 259,142 and 515,486 post-graduates for 1989 and 1992 respectively in different fields *related* biotechnology. For the same periods, Indian universities produced 28,904 and 33,684 doctorates respectively. These included life sciences and chemistry. Further, in the fields directly related biotechnology Indian universities procured 2424 (biochemistry) ; 804 (applied biology) ; 10 (biophysics) ; 25 (molecular biology) 54 (molecular biophysics) ; 125 (genetics) and 322 (microbiology) doctorates for the year 1992.

In so far as the field of biotechnology alone is concerned, Indian universities produced 1017 post graduates (ie M. Scs) and 107 doctorates for the year 1991-92. It is estimated that these numbers will increase to about 2156 (for post graduates) and 96 (for doctorates) for the year 1996-97. For the data available for 1986-90, a report on the manpower analysis for biotechnology indicated that out of 276 post graduates, 100 (36 %) were employed in the Indian industry or research institutions and 176 (64 %) went abroad for pursuing Ph. D courses. What is also worth noting here is that before 1986 the percentage of neophytes in biotechnology and closely related specialities such as molecular biology who went abroad for higher professional training might be placed at as high as 80 %. With the rapid institutional and higher educational base from the mid 1980s, the percentage of post graduate students going abroad has come down to about 40-50 % for the last few years. Given that India produces substantial number (over 2000 M. Sc’s per year for the current period ; and 1200-1300 per year during the last five years) of biotechnology students every year, what is important behind these numbers and statistics is the ability of the country to retain a substantial number (i.e. about 50 %) of the intellectual work force ; and at the same time attract a potential number of trained Indians in the area from abroad. This feature emerges from our porsopographical survey of leading biotechnologists and molecular biologists in the university and national laboratories centres shown in Table 3. This survey indicated that in the leading biotechnology and molecular biology centres such as Nil, CCMB, NCL and at the university departments at Poona, Madurai Kamraj University, Delhi, Baroda, among others, more than 75 % of the leading scientists (responsible for the creation of research centres/departments) have spent between 3 and 5 years abroad mainly in western Europe and North America before taking up responsible positions in India [3].

Not withstanding the personal and nationalistic reasons there are professional reasons and features related to the local/national growth of specialities which checks both the processes of “ potential ” brain drain and brain gain. This being the sufficient condition, there are other sociological features (considered as essential conditions) relating to the concept of scientific communities. We will explore these in the next section.

Features of professionalisation and scientific communities

Biotechnology is generally defined as the " application of science and engineering principles to the processing of materials by biological agents to provide goods and services " (see Mani 990 : M-1 15). What is also recognized is the feature that the fostering of biotechnology is closely related to various basic science specialities such as molecular biology, biochemistry, microbiology, chemical engineering, genetics etc. In other words, without a strong professional base in these basic science areas, the application and commercialization of biotechnological processes are difficult to emerge and sustain. This feature is reflected from the Indian experience. Though the Indian basic research base in the conventional biological sciences can be traced to the turn of the present century, creation of basic research base with recognizable research groups in the disciplines of modern biology (excluding biotechnology) took place during the late 1960s and 1970s. It is only after the growth of modern biology specialities during this period, the specialist community created a demand for fostering the field of biotechnology [4] which is intimately connected to molecular biology. As Balram and Ramasehan (1991 : 509) in their introduction to the special issue of *Current Science* on " Biotechnology in India observe ",.research in molecular biology also promises many practical dividends. Crop improvement in agriculture, development of vaccines and diagnostic procedures for parasitic diseases, and even the prospect of rational drug design are some areas of special relevance in India ". As shown in Table 3, over 28 leading R & D centres emerged during the last 15 years. Almost all these groups emerged from the centres at universities and national laboratories which had earlier established a basic research base in different areas of modern biology. For instance, the specialized National Institute of Immunology at New Delhi under the leadership of G.P.Taiwar developed several immunodiagnostics, anti-fertility and leprosy vaccines. The institute has an extensive programme on embryo biotechnology; the Centre for Cellular and Molecular Biology at Hyderabad is now recognized as the key centre for DNA fingerprinting techniques; the Biochemical Division at the National Chemical Laboratory at Poona evolved novel methods for tissue culture propagation and plant biotechnology; and the Institute of Microbial Technology at Chandigarh has developed processes for industrial fermentation, genetic engineering and new method for enzyme conversion. As one of the leading Indian molecular biologist observes, " from almost a zero level in the early 1980s, we now have at least two dozen laboratories where good recombinant DNA expertise is available. At the technology level, the successful demonstration of embryo transfer in animals; development of antigen-antibody-DNA-based diagnostics; RFLP analysis and DNA fingerprint analysis; and the cloning of a variety of genes attest to a high level of competence in modern biotechnology " (see Padmanabhan 1991 : 51 1).

As shown in Table 1 about fourteen specialist journals in different areas of modern biology were launched from early 1960s upto mid 1980s. The launching of a *Joumal of Microbial Biotechnology* in 1986 can be considered as an important milestone in the professionalisation of biotechnology in India. The publications in biotechnology can be seen in Table 5.

Among the two professional societies viz., Society of Biological Chemists and the Guha Research Conferences (GRCs), the part played by the latter in catalysing the professional growth of specialities (including biotechnology and molecular biology) in modern biology has been quite noteworthy [5]. From 1965 members of the GRCs meet every year and the presentations in this meeting mainly deal with the cutting edge of modern biological sciences. It has a membership of about 100 leading scientists but invites scientists and technologists in the forefront of the biological sciences to discuss their work. presentations in the annual meetings of GRC are considered as a recognition of' some considerable standing by the neophytes in the

biological sciences. There is no formal hierarchy and permanency in the membership. Irrespective of the position of a member, the professional body suspends the membership if the person had not participated in annual conferences for three years. The GRC members are considered as the biological elite in the country and some of its leading members (numbering about 20) have been responsible for guiding the growth of modern biology, particularly biotechnology and molecular biology in India (see table 4). GRC can be considered as an " invisible college " in biological sciences, which over the last three decades, brought the leading modern biologists under a single platform and at the national level it provided a sense of community and intellectual pride. Besides the GRC and the Society for the Biological Chemists of lndia [6], there are several small informal networks and discussion groups.

Organizing international workshops and conferences in the areas related directly to biotechnology growth has been another feature of professionalisation, particularly, in bringing the leading biologists from India and abroad together. For instance, as P.S.Sarma who organised the first summer school of biochemistry in India in 1962 at Srinagar observed, " I arranged the proceedings with two main objectives ; firstly to cover the important recent developments in the subject and secondly to bring together active research workers in the country to have an exchange of ideas of mutual benefit by interaction and unhurried discussion " [7] Over the last two decades, as the review of Burma (1992) indicates, 18 national and international professional workshops and symposiums were organized by the leading biologists in India. These eighteen professional meetings are noteworthy in the sense that they were intellectually structured high level meetings. For instance, P.M. Bhargava organised first symposium on " Nucleic Acids structure, biosynthesis and function " in 1964 at the Regional Research Laboratory, Hyderabad. Nobel Laureate Francis Crick participated in this symposium along with other leading biologists in the world at that time. As Burma (1 992 : 221, 222) notes, the publication that came out of this symposium, " is perhaps the first written record of the advent of molecular biology in the country ".

Another example of high powered symposium is the one organized by G.N. Ramachandran in 1978 at the University of Madras on " Biomolecular structure, confirmation, function and evolution ". This meeting was chaired by the Nobel Laureate Dorothy Hodgkin and participated by another Nobel Laureate Severo Ochoa. Some of these workshops and symposiums not only strengthened the international connectivity to Indian molecular biology and biotechnology, but in varying ways played a catalysing role in strengthening and inaugurating the formal research groups in these areas in the national laboratories and universities.

If the higher training (i.e. production of M.-cc graduates and Ph. Ds) is taken as one of the indicators for the professional growth of a field - then the biotechnology during the last decade demonstrates moderately good results. Beginning with 220 M. Sc students and 40 Ph. Ds per year in the early 1980s, the figure increased to 1017 M. Sc students and 107 Ph. Ds per year in the early 1990s. As noted in an earlier section, this figure is estimated to reach 2156 M. Sc students and 96 Ph. Ds per year for current period.

The spin off from the professional growth of biotechnology and closely related fields of research has been the expansion of biotechnology industry in the country. Recognizing the growing status of the biotech industry in the areas of chemicals, drugs, agriculture, medical and health, diagnostics etc., the DBT in collaboration with financial institutions like Industrial Development Bank of India and the private sector companies set up an organization called the Biotech Consortium India Ltd (BCIL) in 1990. The major objective of this organization is to facilitate the transfer of biotechnology processes into the industry and aid its commercialization. There are over 175 biotechnology industries in India, of which 160 are in the private sector and 15 in the public sector [8]. As pointed out earlier, 36 % of the trained postgraduates were absorbed into the indian industry and institutions for the period 1986-90. The future expansion of biotechnology industry is likely create a further demand for the absorption of trained scien-

tific and technical personnel in India. With the expansion of the biotechnology industry and the professional competence in the field, some multinational corporations have entered into the Indian market by setting up research and development units and as well as began commercial operations from India. In this growth of biotechnology industry, the role of basic research groups in the national laboratories have been remarkable in the recent years. For instance, the Swedish giant A.B. Astra group had set up a laboratory in Bangalore in the field devoted to biotechnology in collaboration with the molecular biophysics group at the Indian Institute of Science. Similarly, the National Institute of Immunology at New Delhi has been an active partner in the development of a lndoFrench venture for the production of vaccines. Based on the anti-fertility vaccines developed at this institute, the group had collaborated with the Karnataka state public sector unit for its commercial production.

Without the sustenance of a research and higher technical training base, the inputs to the growing biotechnology industry was not possible. But when we consider other crucial features behind the professional sustenance of this field over the last 15 years, one more feature stands out clearly. From a sociology of science perspective this relates to the concept of scientific communities [9]. Beyond the growth of numbers, the emergence of scientific communities or specialist groups in a particular speciality signifies the emergence of intellectual climate (i.e. professional societies, journals, conferences and workshops and informal networks of communication), leadership and its role in the institutionalization of the field including giving a direction, university courses and chairs involved in producing neophytes in the field, political and economic legitimacy to ensure state funding, a viable number (say 5 to7) of research groups working in the field at the frontiers and basic research level which have certain degree of national and international recognition, a system of rewards and recognition which provides motivation for the scientists, mobility of scientific and technical personnel and above all a pattern of international scientific connectivity with global elites and related community of specialists. We have already thrown light on some of these aspects and the limited space do not permit to explore all the features here. However, we will deal with some features such as the intellectual leadership, international connectivity and the major workshops which propelled the basic area of molecular biology.

The Table 4 shows some of the leading scientists in modern biology who were responsible for the institutionalization and professionalisation of biotechnology in the Indian universities and research institutions [10]. In many centers the initial leadership given by the leading scientists in the previous decades has given rise to the second generation of leadership. For instance, the pioneering work done by G.N. Ramachandran on triple helical structure of (who is considered as the father of Indian molecular biology) led to eminent groups in molecular biophysics at the University of Madras and Indian Institute of Science in the 1960s and 1970s. The second generation of leadership at the Indian Institute of Science after the 1970s is led by Sasishekharan, G. Padmanabhan and P. Bairam. Similarly, the initial leadership given by P.M. Bhargava in the creation of more than five groups in molecular biology at CCMB is led by others like Laiji Singh, Balasubramaniam, C.R. Dass and others.

As Table 4 indicates, many of the pioneers who were responsible for the growth of the biotechnology and molecular biology centers are connected with the foreign research groups and laboratories in North America and Europe. Personal interviews conducted with leading scientists reveals that much of their interaction, mobility and communication takes place with the relevant research groups and individual elites abroad than in India. It is also revealed that the dominant mode of foreign connections of the Indian centres and elites, also have a bearing on the Ph. D students [11]. It is estimated that these Institutions (identified in Table 4) account for 600110 of the Ph. Ds and post doctorates produced in India during the last decade. Out of this, about 50 % of doctorates go abroad. Rough estimate is that the 40 % of the people going abroad for doctorates do return back, mostly to the institution of their higher training. The interview

data with the leading scientists also reveals a very week interaction between different research groups/institutions within India compared to the links abroad. This is also followed by a weak process of mobility of scientists and inter-lab/institution collaborative projects between different institutions within the country. It is here that the " invisible college " like the Guha Research Conferences plays an important part in bringing the leading Indian scientists under a single platform and gives a meaning and a sense of national community. To what extent such professional networks and societies makes good of the weak interaction process between different groups within the country remains to be explored further.

Towards Biotechnology Network

Following Callon and Thomas Hughes and others, the perspective of networks in its varying forms been used by the STS studies. Drawing from the works of Callon et. al (1 990), a network is said to be operating when the links between the *Poles* of science, technology and the market are established ; and when there is a multiflow of information and sharing of resources for the constitution and production of novel knowledge, methods, products and services etc., by different poles of the network. As shown in figure 1, two additional Poles namely, the government pole and the international scientific community pole are included here compared to the original schema give by callon et al. Some salient features in the growth of biotechnology network in the Indian context are as follows :

i) Socio-historical growth of biotechnology network during the last few decades from 1960s to 1990s has progressed in mainly three phases : 1960s to late 1970s ; the period from 1980 ; and the period from the late 1980s. These phases by no means are watertight compartments ; they are only distinguished for analytical reasons. Whilst the first two phases are closely intertwined in their historical progression ; the third phase evolved distinctly from the late 1980s. It may be noted that the first two phases progressed in parallel from the 1980 ; and similarly all the three poles progressed in parallel from the late 1980s.

ii) The first phase (1 960s to late 1970s) reflects the institutionalisation and professionalisation of basic modern biology specialities relevant to the emergence of biotechnology as dealt in the first section. During this phase the institutions and research groups were constituted and this phase signifies the development of the *science Pole* relevant to biotechnology. As noted in the earlier sections (2 and 4), the international connectivity (another pole) of Indian scientists played a significant part in this process. More importantly, the science pole during this phase gained considerable politico-economic and scientific legitimacy for fostering the new field of biotechnology.

iii) The Second phase (from 1980) marks the emergence of biotechnology as a specialised field of activity in the Indian context. Towards the constitution and growth of this field, *three main actors or poles* were responsible. These are the *government* (creation of the Department of Biotechnology which ensured state funding), the *academia* (university chairs, courses in higher education and the development of relevant infrastructure etc.) and the *research and development* centres or *technology* pole (both in the universities and the national laboratories). The major feature during this phase as dealt in section 4 was the constitution of specialist groups in biotechnology numbering more than 28 ; and the establishment of specialised national laboratories devoted to this field or research and development activities. In this the part played by the poles of the first phase have been considerable.

iv) The third phase, which began from the late 1980s, signifies the emergence of a *market pole* with close interconnections to science. *academia. technology* and government poles. A good

example is the collaboration between the molecular biophysics group of the Indian Institute of Science and the Astra Research Centre India (subsidiary of the Swedish pharmaceutical MNCA.B. Astra) for the development of technological processes and products in the field of biotechnology which are commercially viable. Other examples are the new public and private sector companies in biotechnology which emerged with a close nexus with the academia and research groups. Rather many companies have emerged due to the work done in the national laboratories and academic units.

v) It is seen that the biotechnology network is overbearingly dependent on the basic research pursued in the relevant specialities of modern biology and it is here the relevance of scientific communities and the process of professionalisation assumes importance for its efficient functioning and sustaining linkages with the market pole.

vi) In the constitution of biotechnology network, the second stage particularly the establishment of research and development pole is seen to be associated with the problem of brain drain. In other words, a network with a strong research and development pole stands to check the process of brain drain and to some extent attract the return migration of scientists. However, to sustain the production of human resources from the academia it is essential that the market pole is developed to a considerable extent.

Concluding remarks

Going beyond the quantitative and input-out analysis vogue in the perspectives dealing with international scientific migrations, the present study sought to focus on the sociological perspectives, in particular, sociology of scientific communities and networks to explore the problems underlying the phenomena of brain drain and brain gain. The study is focused on a frontier speciality of science and technology - the biotechnology field in the Indian context. In this framework, the main question which concerned the empirical study is : What is the relationship between the concept of scientific communities and professionalisation of science with the problem of brain drain and brain gain ?

The exploration on the growth of biotechnology field in the Indian context lends considerable support to the hypothesis that the institutionalisation and growth of specialist communities over a period of time has a direct bearing on the problem to check the process of brain drain. what is also clear from this study on biotechnology is, it is not just sufficient to create institutions of research and higher training by inducing funds to foster a frontier field of science, it is essential that an intellectual climate is induced or created by the community concerned. What this entails is a certain viable number of research groups, university chairs and centres of higher learning with research infrastructure, professional societies or informal networks of collegiate pattern, local and national journals and above all sources of intellectual leadership who give a direction and leadership in the emergence of specialist groups and who can act as “ gate keepers ” to international connectivity in the relevant field of research. Closely embedded in this intellectual climate is the feature of professionalisation which points to a recognizable community or specialist groups who are involved in the fore front of the field and whose research contribution furthers the field with new frameworks, methods, areas etc. There are three aspects to this notion of professionalisation observed in the field of biotechnology in India. The first is the professional basic research base created in the areas directly related to the emergence of biotechnology in biochemistry, molecular biology, cell biology, immunology, genetics and virology. The second aspect is the underpinning of these basic stocks of knowledge for furthering the techniques and methods in biotechnology which related to genetic/protein engineering, enzyme engineering,

hybrodoma, diagnostics and techniques of tissue culture - to name some prominent ones in which the Indian community developed recognizable competence. The third is the question of connectivities to the practical and production processes which are generally seen as the potential of commercialization and market development in the field of biotechnology.

Among these features, the growth of recognizable communities at the local-national level which sustain the field of research in terms of R & D groups is seen to be central to the process of professionalisation. As shown in the study, India began to embark on biotechnology from the late 1970s and more vigorously from the early 1980s. Over the last fifteen years or so, India witnessed considerable growth of the field in terms of R & D groups in the national laboratories and university departments. As Table3 shows there are over 28 centres where research groups in biotechnology have come up during these years. As indicated in this table on the position of fulltime equivalent research and teaching positions during 1982 and 1995, there has been a recognizable expansion of the centres and scientists or faculty positions. Whilst the research efforts of pioneers in modern biology gained tremendous political legitimacy for drawing the required funds for the institutionalisation and expansion of biotechnology, no less important was the part played by a governmental body - the Department of Biotechnology from 1982 in aiding the task of building the field of biotechnology in India. DBT not only sponsored post graduate and faculty positions during the last decade in about two dozen university departments but systematically planned to support programmes in various new facets of biotechnology. As one of the leading biophysicist commented, for a government outfit, DBT has been extraordinarily active, vibrant and forward looking' (See Padmanabhan 1992 : 541).

The point that trained intellectual human resources would have vanished without these specialised laboratories, leaders and R & D groups stands out glaringly in the Indian context. During the last half decade India is producing around 1200-1300 post graduates (ie M. Scs) and around 100 doctorates per year in biotechnology. It is seen that the country is able to retain about 50 % of the intellectual work force produced. Even though a significant percentage of this intellectual work force go abroad, the rate of return migration in the field directly related to biotechnology has not yet reached an alarming situation as reflected by several leading biologists. It is estimated that a high percentage (75 %) of the leading biologists responsible for the creation and strengthening the biotechnology related centres in India (see Table 3 and 4) have spent, on an average, between 3 to 5 five years abroad in one of the leading internationally recognized institutions in North America and Europe. This international connectivity in the growth of modern biology and biotechnology has been very strong during the last two decades or so. Interviews held with some leading members of the community reveals that the main reason influencing the decision of Indian scientists willing to come back to India in this field are the institutional growth of the field and a reasonable professional context created over the last decade. The return migration of established scientists and the strengthening of the field in the Indian context appears to be closely associated. As one of the leading molecular biologist recently commented, " with the development of several schools of molecular biology in different parts of the country and the return of a number of young enthusiastic, well trained molecular biologists from abroad the field of molecular biology is very rapidly widening " (see Burma 1992 : 224).

Since the growth of specialist groups and professionalisation were seen to have a bearing on the problem of checking brain drain, the factors sustaining the research groups assumes considerable importance. It is here the existence of invisible colleges like the Guha Research Conferences and the research communication channels such as the growth of local-national journals in the relevant field of biotechnology were also seen as factors related to the sustenance of research base and hence the problem of checking the process of drain.

From a sociology of science perspective, the feature of social organization of research groups was observed to have an important bearing on the sustenance of research groups. There are a host of factors in the ambit of social organization which relate us to the research traditions and excellence set by the pioneering leaders, the style of leadership, recruitment patterns, distribution of local-organizational rewards, avenues for mobility and participation in conferences etc. It was not possible to generate enough data to conclusively comment on these aspects in relation to the biotechnology field in this study but some interviews conducted with leading biologists reveal some insights. Tata Institute of Fundamental Research ; Indian Institute of Science ; Center for Cellular and Molecular Biology ; Madurai Kamraj University and the National Institute of Immunology are the five centers where the field of biotechnology and molecular biology witnessed considerable growth in terms of research groups and have gained recognition both nationally and internationally. The intellectual leadership and their recruitment patterns which laid emphasis on " selecting the best available talents in the country " principle appear to be the main factor. Another feature of the leadership in these national laboratories has been the emphasis on encouraging mobility of scientists to foster new ideas and arrest the process of " fossilization " in research.

India produces the largest number of post graduates and doctorates in the modern biological sciences compared to other developing countries. As noted earlier, a significant proportion of the trained personnel (about 50 %) go abroad and yet the Indian biological elite do not consider it as an alarming situation. Interviews held with some scientists reveal that since the west still dominates in the frontiers of molecular biology and biotechnology ; and that the developing countries continue to lag behind the west for many more years - India should evolve appropriate policies to tap this frontier constantly. The best way to do is to keep the outflow of scientific and technical human resources going but at the same time make efforts to bring back the potential ones back into the country. Even if the country is able to attract 15 to 20 % of the scientific " cream " every year from abroad, the scientists interviewed feel, it will give a good boost o the professional standing of the field. Towards mapping the biotechnology network between research, academia, industry and the market, three main phases are identified as dealt in section : 5 and depicted in figure 1. The way in which the network evolved over the last couple of decades from the disciplinary origins of modern biology in the late 1970s to constitute the poles of academia, R & D groups, government, international scientific community from the early 1980s to the evolution of biotechnology and industry pole from the mid 1980s - the network depicts an innovation or pipe line model of growth. Without the inputs from, and interconnectivities with, the basic research disciplines of modern biology - the biotech network could not have emerged. The industrial and the market segment of the network is highly knowledge intensive in that the pole needs recurrent inputs from the basic and applied research, on the one hand, and the academia (being a source of trained human resources) in modern biology, on the other hand. In other words, with the expanding biotech market, this segment of the network which constitutes about 175 enterprises (both small scale and medium size) is emerging as the main source of future employment for the skilled personnel. This segment also attracted foreign collaborations such as between the Indian Institute of Science and Astra India in Bangalore. Whilst the biotech network as a whole, from the mid 1980s, emerged to play a significant role in checking the problem of drain, the industrial segment has begun to attract Indian scientists from abroad in the 1990s. As in other areas and fields, there is a new category of scientist-entrepreneurs emerging in the field of biotechnology.

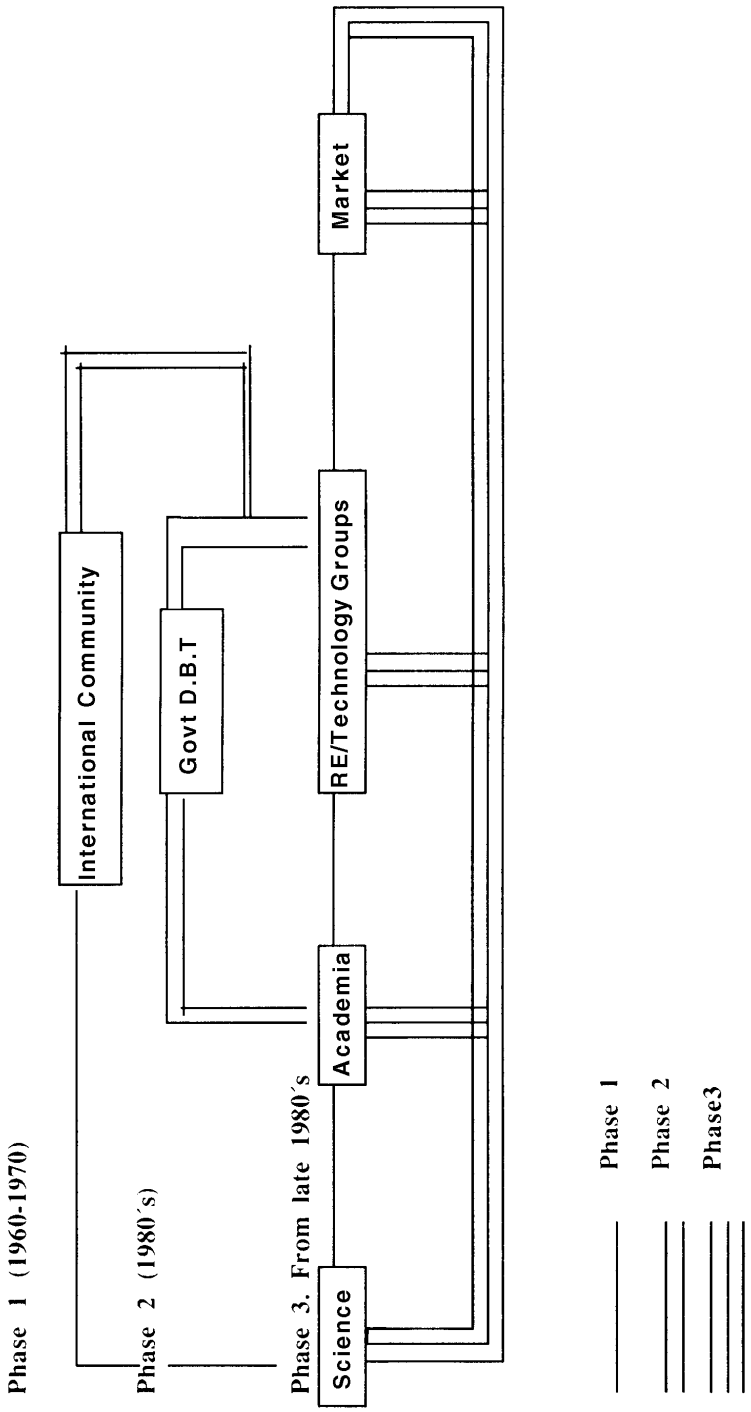


Figure 1. Biotech-Network

Table 3. Biotechnology and directly related research .and higher educational centres in M.Sc/Ph.D/Post.Doc in leading Indian institutions and full-time equivalent positions

University sector	**Thrust of Activity**	**FESIF** Positions in 1982**	**FESIF Positions in 1995**
Universities :			
Delhi University	M.Sc*1 Ph.D/ Post. Doct.	3	8
Calcutta University	-do-	2	7
Poona University	-do-	-	7
Banaras Hindu Univ.	-do-	2	3
Madurai Kamraj Univ.	-do-	2	6
Madras University	-do-	2	4
Jawaharl Nehru Univ.	-do-	4	12
Indian Institute of Sci.	-do-	3	11
Indian Agriculture inst.	-do-	7	23
M.S.University	-do-	2	8
Osmania University	-do-	1	5
Hyderabad University	-do-	1	5
Jadavpur University	-do-	-	4
Christian Med. College	Ph.D/Post.Doc	2	5
All And. Inst. Med. Sci.	Ph.D/Post.Doc	2	11
Ind. Inst. of Tech. (Khar)	M.Tech/Ph.D/Post.Doc	-	5
And. Inst of Tech. (Born)	-do-	-	5
And. lnst of Tech. (Del)	-do-	2	6
Anna University	-do-	-	7
		35	142

* Universities offering M.Sc courses admit 20-25 students per year
**(FES./Full-time) equivalent scientific/faculty

Table 3 contd

Research Institution	**Thrust of Activity**	**FES/F Positions in 1982**	**FES/F Positions in 1985**
CCMB	Full-time Res/Ph.D/P	27	52
Nat. Inst. of Immunology	-do-		49
Inst. of Microbial Tech.	-do-	12	30
Bose Institute	-do-	5	12
Tata Inst. of Fund. Res.	-do-	3	7
Nat. Chem. Lab	-do-	5	15
Nat. Inst. of Chem. Biol.	-do-	12	34
Bhabha Atom. Res. Cent.	Full-time Res	1	4
And. Vet. Res. Inst.	-do-		7
Cent. Rice. Res. Inst.	-do-		5
CSIR Compi. Palampur	-do-		6
Cent. Drug. Res. Inst.	Full-time Res/ PH.DIP.D	6	23
Nat. Inst. Heal. & Fly. Wel	-do-		6
Malaria. Res. Cent.	Full-time Res		4
Nat. Bot. Res. Inst.	Full-time Res/ Ph.D/P.O	8	40
P.G. Inst. of Med. Ed. Res	Full-time Res/ Teaching	1	5
Tam. Agd. Univ.	Full-time Res/ PH.DIP.D		4
Cnt. int. of Med.&Aro.Pits	-do-	3	12
Aligarh Muslim University	-do-		2
Tata Energy Research Cent.	Full-time Res/ PH.D		7
		84	324

Table 3 contd. Major private firms in biotechnology industry in India (Firms with R&D units)

1.	Astra Research Centre	11.	Spic
2.	Ranbaxy Laboratories	12.	Parry's
3.	Lupin Laboratories	13.	Hoechst
4.	Dr. Reddy's Laboratories	14.	ITC Agro Technology
5.	Span Diagnostics	15.	lndo American Seeds Corporation
6.	Unicon	16.	Harrison Malayalam
7	Torrant	17.	Rallis India
8.	A.V.Thomas	18.	Transgene Biotech
9.	Bicon	19.	Bangalore Genei
10.	Mailadi	20.	Hindustan Lever

Table4. Main leadership in biotechnology and related fields, the centres initiated and their foreign connectivity from the 1970s

Scientist who have the initial leadership	**Foreign connection: collaboration/training**	**Emergence of a centre/ department/institutions**
G.N.Ramachandran	n.a	University of Madras, 1960s;
Gopinath Kartha	n.a	Indian Institute of Science,1970
Sasishekharan	Stanford Univ., USA	Indian Institute of Science,
G.Padmanabhan	n.a	after 1970s
P.Bairam	Carneige Mellon, USA	
Obaid Siddiqui	Caltech Labs, USA	Tata Institute of Fundamental Research from 1960s
P.M.Bhargava	Max Plank Inst. Germany.	Centre for Cellular and Molecular Biology (1970s)
B.K.Bachawat	Univ. of illinois, USA	Indian Institute fo Chemical
Jyotirmoy Das	Rochester Univ., USA	Biology 1970s and Delhi Univesfty after 1980
G.P.Talwar f	Seagal Lab., USA Pasteur Institute, France	National Institute of immunology
M.Damodaran	n.a	National Chemical Lab.
John Bamabas	n.a	-do-
V.Mascamehas	n.a	-do-
Maharani Chakravorty	Cold Spring Harb. lab	Banaras Hindu Univ.
D.P.Burma	NIH, USA	-do-
B.B.Biswas	Abrams Lab.	Bose Institute
V.R. Muthukkarpan	Univ. Wisconsin, USA	Madurai Kamraj Univ.
K.Dharmalingam	Univ. of Boston , USA	-do-
V.V.Modi	Univ. of llinois, USA	Poona University
V.L.Chopra	Edinburgh Univ., U.K	Indian Agh. Res.institue

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[1] The division of biochemistry under P.M.Bhargava eventually led to the creation of CCMB in late 1970s ; and similarly the work of G.P.Talwar led to the creation of Nil in the early 1980s. B. Bachawat moved to Indian Institute of Chemical Biology and then to the Delhi University, South Campus.

[2] The quantitative data for this section is drawn from a report on Manpower sponsored by the Department of Science and Technology, New Delhi, see Visalakshi and Sharma (1995).

[3] The most notable names include : K. Dharmalingam, G. Shanmugam and Muthukkaruppan at Madurai Kamrai University ; P. Bairam, Sasi Shekharan, T. Ramasarma and G. Padmanabhan at the Indian Institute of Science ; P.M.Bhargava, Laiji Singh, C.R.Dass, among others, at the Centre for Cellular and Molecular Biology ; G.P.Talwar and others at the National Institute of Immunology ; V.L.Chopra and R.S.Paroda at the Indian Agriculture Research Institute ; B.K.Bachawat and S.C.Maheshwari at the Delhi University ; D.P.Burma and Maharani Chakravorty at the Banaras Hindu University ; Jyotirmoy Das at the Indian Institute of Chemical Biology ; V.V.Modi at the Poona University ; Cbaid Siddiqui at the Tata Institute of Fundamental Research and P.N.Bhatt at the Indian Veterinary Research Institute ; and John Barnabas and V. Mascarnehas at the National Chemical Laboratory.

[4] To have an idea of the international scene in the commercial importance of biotechnology, the following major events may be noted :
1973 - First cloning of gene
1974 - Recombinant DNA (RDNA) experiments first discussed in a public forum (Gordan Conference)
1975 - U.S. guidelines for RDNA research outlined (Asilomar Conference)
1976 - First firm to exploit RDNA technology founded in the U.S (Genetech)
1980 - Diamond V Chakrabarty won the case in the U.S Supreme court for patenting the live organism for the first time
1980 Cohen/Bayer patent issued on the technique for the construction of RDNA
1981 First monoclonal antibody diagnostic kits approved for use in the U.

[5] The first meeting of the GRC was organised in 1960 at Khandala near Pune and it was known as the " Khandala Type of Conferences ". The name of GRC came after the well known biochemist G.C.Guha. The idea of GRC was conceived in 1958 by a young group of biochemists who returned from abroad to pursue serious research in the frontiers of biology in India.

[6] As noted earlier, this national body was created in early 1930s. This society played an important part in the first few decades after its creation and still continues to play. The scientific society also publishes a journal. For the lack of space it is not possible to further elaborate the work and significance of this August body.

[7] This quote is taken from Burma (1992 : 221). Information for this section on symposiums and workshops on molecular biology is drawn from this source.

[8] The value of biotechnology market including the conventional fermentation based microbial products is estimated at 890,00 million rupees currently. The health care accounts for 60 % ; agriculture products 15 % ; and the balance is accounted by chemicals, alcohol and starch based products. Indian exports from the biotechnology products is estimated at 3000 million rupees currently.

[9] This emerges from an earlier study which explored seventeen research groups in physical, chemical and biological sciences during 1992-94. This study, to some extent, established a close association between the concept of communities and the phenomena of brain drain. See Mahanti et. al (1995).

[10] It maybe noted that the table is not theo outcome of an exhaustive exercise and possibly it misses out many leading personalities. The work on this still in progress and hence should be deemed an interim report.

[11] Interviews with leading biologists were conducted by the team involved in an earlier study (see Mahanti et. al 1995. The foreign connections is revealed from porsopographical survey of 25 leading biologists).

The “Brain Gain” in the Mexican Scientific Community: An Alternative Outlook

Nora Narvaez-Berthelemot

Angélica María Rosas

Introduction

The success of scientists from developing countries, living abroad, is a source of satisfaction and pride for their colleagues, friends and relatives in their native countries. The 1995 Nobel prize in Chemistry was awarded to a group of scientists from a North-American institution which included a well-known researcher of Mexican origin. This man was born and educated in Mexico. His advanced studies and his original scientific production were conducted, up to now, abroad. Could he be considered, then, to be a “Mexican researcher” ? Is it relevant that he is, or is not, naturalized North-American ? What is important is that his professional commitment, until now, has not been to Mexico but to the United States. The same applies with scientists who move to Mexico or other such countries. Sometimes after years of study and work in other places, these scientists finally settle down to plant roots in a new land. These immigrant scientists identify themselves with the problems and needs of their new countries. They work in the same conditions as their new colleagues. Their scientific production and the transmission of knowledge they have acquired favor the community of their adopted countries [1]. For example, three of those awarded National Prizes in the Sciences in Mexico in 1995 were born far from Mexico, but over several years they had become involved in the problems, needs and aspirations of their present country of residence, to which they have made original scientific contributions. When they publish, they are already considered Mexicans, since scientific production is quantified according to the author’s institutional affiliation. It is true that in a world without frontiers one could argue that if a scientist emigrates, the loss for one country represents gain for another [2]. To counteract the brain drain in Mexico, measures were taken to repatriate lost talents. The government, for example, actively recruited scientists and specialists from the Soviet Union to work in universities and national research institutions, both because of their excellence and their modest requirements [3].

This situation, however, is not new. In 1940, as a consequence of the war, scientific activities centered in Europe were interrupted and the Rockefeller Foundation began to explore opportunities in Latin America. To begin with, they attempted to determine which North-American scientists could work there and what facilities and opportunities were available in the field of natural sciences [4].

This situation raised several questions : Is the participation of these immigrants representative of the scientific development of a country ? What is the percentage of scientists of foreign origin in Mexico ? What was their participation in the production of scientific papers in a determined period of time ? What countries do they come from and what is the quality of their performance in their new country?

Methodology

In order to identify the scientists working in Mexico whose country of origin is other than Mexico, the SNI data base edited in 1993 was used as a source.

Mexico’s System of National Researchers (Sistema Nacional de Investigadores - SNI), was created in 1984 to encourage research and stimulate established researchers of remarkable quality, as well as those beginning a carreer in research. In addition, it was designated to track the increase in scientific production in areas and sectors whose development would be an important factor in the economic and social advancement of the country.

The compact disc contains 3,937 records, representing established members of the Mexican scientific community through 1993. It does not contain information on candidates to the SNI [5], of which there were 2,274 [6] in 1993. With each name it includes publications and other data with relevant information. With the compact disc the SNI promotes Mexican science at all levels, offering valuable information on the national scientific structure. This database must be considered the only formal source allowing a controlled sample of the scientific community in Mexico to be consulted.

For the purpose of the present study, it was necessary to transfer all the files to a separate data base, in order to codify and analyze them. Each record was identified by assigning labels with the following information :

Gender: As this information was not contained in the SNI compact disc, it was necessary to review each record. For those names not easily identified, it was necessary to contact the researcher in order to assign an F for female and an M for male to each record.

Place of origin: The data registered in “place of birth” (F = foreign, M = mexicans), were not entered in all the records in the original SNI database. So it was also necessary to ask the scientist directly.

Locality: This item was not relevant for scientists born in Mexico. For those not born in Mexico a code was assigned to indicate those who work in the capital and those who work in the rest of the Republic. It was assigned by geographic location inside the Republic of Mexico. To complete the information the Catalog of Institutions registered in the Latinoamerican Bibliography database (1993 edition) was used and compared with the SNI directory published in 1991.

Discipline: It was codified only for those records with a non-Mexican place of origin. The SNI database has its own classification of disciplines with 41 categories : administration, agronomy, anthropology, astronomy, architecture, library and filing, biology, health sciences, political sciences and public administration, accounting, demography, law and jurisprudence, economics, education, pharmacology, physics, geophysics, philosophy, geography, geology, history, information science, aeronautical engineering, civil engineering, engineering of communications, electronics control, electrical engineering, industrial engineering (marine and port) mecanical engineering, mining engineering, nuclear engineering, petrolium engineering, chemical engineering, textile engineering, linguistics, literature, filology and fine arts, veterinary medicine, odontology, fisheries, psychology sociology and zoology.

For the present study these 41 disciplines were regrouped in two main groups. One for science and technology, following the classification of Computer Horizon Inc.[7], and one for the social sciences and humanities not included in the CHI classification. The science and technology group is divided into : Clinical medicine, Biomedicine and Biology, (later grouped together into only one category of Life Sciences), Earth & Space Sciences, Engineering & Technology, Chemistry, Physics and Mathematics.

Once the records of the scientists of foreign origin were identified and codified, those in the disciplines of Clinical medicine, Biomedicine and Biology were identified, taking into account that 60 % of the scientific papers published by Latin American researchers, alone or in collaboration with foreign colleagues, deal with Life Sciences [8]. In Mexico this percentage is 75 % of its total production from 1968 to 1970 [9], and 58.3 % from 1980 to 1990 [10].

These records were used for a micro study, in which each scientist in the field of Life Sciences was analyzed one by one directly from the SNI database under the field “Scientific Production”. Their production and its distribution was quantified from the date of publication of the first article in 1941, through 1990. For the decade of the 90s, an estimate was made for three years (91, 92, 93), taking into account the gap between publication and the delivery of the information to the SNI. These data contain the declared production by the scientists for 1991 through 1993, plus information on articles without a specific year of publication but with the notation : “papers in revision”, “submitted for publication”, or “in preparation.”

In this way production was quantified for each scientist. This detailed review gave us a picture of the number of scientific papers published at a national, Latin American and international level by non-Mexican scientists, in comparison with their national colleagues. The field of “scientific production” also allows us to observe the degree of collaboration by identifyng the coauthorships of each publication. It must be noted, however, that with a methodology as relatively new that of as the SNI’s CD-ROM, the figures obtained for the production of papers were not taken as absolute and exhaustive in the present study, but rather as a tendancy and as an indicator of the research activity in a specific group.

Results

The compact disc of Mexico’s System of National Researchers (Sistema Nacional de Investigadores, SNI) edited in 1993, includes 3,937 [11] records, corresponding to the member scientists. Of these, 250 (6 %) were impossible to identify. Of the remaining 3,687 records it was possible to identifiy 544 (15 %) as being of foreign origin, which is the figure used for the present study. Of the total (544) records of scientists of foreign origin, 393 (72 %) were men and 151 (28 %) women (Figure 1). This ratio is similar to that of CONACYT/SEP [12], with 77 % men and 23 % women for the total membership of the SNI, in the same year. This similarity of percentages is not the same when we compare geographic location inside the country. Of the 544 researchers of foreign origin, 422 (78 %) work in the capital and 122 (22 %) in the provinces (Figure 1). In the CONACYT/SEP [13] figures, the numbers are 59 % and 41 % indicating that most of the scientists of foreign origin are centralized in universities and research institutions in the capital of the Mexican Republic.

Table 1 shows 56 countries of origin for the 540 researchers. Four of them reported their origin as foreign without giving the name of the country. Although an attempt was made to explore their motives for moving to Mexico and leaving their countries of origin, some researchers answered “personal reasons” without expanding on the subject. Others preferred not to answer, arguing the absence of an official demand.

Figure 1 also shows the disciplines in which the foreign scientists living in Mexico work. Most of them, 248 (46 %), are dedicated to the Social Sciences and Humanities, followed by the field of Life Sciences with 128 (24 %).

Table 2 shows a comparison with the 1993 CONACYP/SEP indicators [14] with respect to distribution of the research areas. Although it shows a similar distribution with a slight emphasis

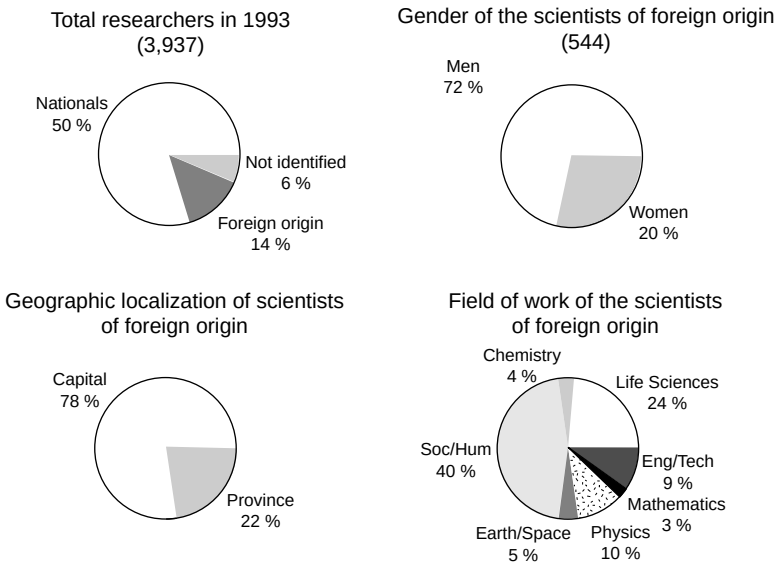


Figure 1. Foreign researchers in the Mexico National Researchers’ System (1993)

on Biology, Biomedicine and Chemistry for the SNI researchers, the number of foreign scientists in the Social Sciences and Humanities, almost 50 %, is remarkable compared to their low representation in the areas of Engineering and Technology when compared to the total number of scientists in those fields.

Table 1. Distribution by country of origin of the foreign scientists residing in Mexico (1993)

Country	Number	Country	Number
United States	69	Cuba	3
Argentina	68	Holland	3
Spain	56	Israel	3
Chile	39	Nicaragua	3
Poland	29	Yugoslavia	3
France	22	Austria	2
Germany	21	Costa Rica	2
Italy	19	Denmark	2
Colombia	16	Honduras	2
Guatemala	16	Hungary	2
India	15	Iran	2
England	15	Marrocco	2
Peru	13	Rumania	2
Uruguay	11	Sweden	2
Belgium	9	Turkey	2
Japan	9	Ucrania	2
Brazil	8	Afganistan	1
Russia	8	Africa	1
Czechoslovakia	7	Argelia	1
Switzerland	6	Cyprus	1
Venezuela	6	Korea	1
China	5	Greece	1
Ecuador	4	Haiti	1
El Salvador	4	Paraguay	1
Puerto Rico	4	Portugal	1
Dominican Republic	4	Senegal	1
Bolivia	3	Zambia	1
Bulgaria	3	Foreign (way reported)	4
Canada	3		
Total	492	Total	52

Source: CD-ROM Sistema Nacional de Investigadores, 1993

Table 2. Distribution of fields in the areas of work of the SNI, scientists (1993)

Field	Total Scientists* (3,959)	Scientists of foreign origin** (544)
Biology, Biomedicine, Chemistry	1,223 (31%)	174 (32%)
Engineering & Technology	954 (24%)	51 (9%)
Physics, Mathematics	705 (18%)	71 (13%)
Social Sciences & Humanities	1,077 (27%)	248 (46%)

*Indicators CONACYT/SEP, 1993

**CD-ROM Sistema Nacional de Investigadores, 1993

According to established methodology, we grouped Clinical Medicine, Biomedicine and Biology in the main field of Life Sciences, resulting in a total of 128 resesarchers of foreign origin working in this area. This micro study allowed the quantification of their production. The distribution of the publications over a period of five decades shows the increasing number of publications. In the 80s the production of the 70s is tripled, and for the first three years of the 90s the projection is six times greater than what was published in the 70s and twice the production of the 80s. It was also observed that coauthorship of publications increased among these researchers each year between 1941 and 1990, and has now reached 83 %. The balance in publication practices must be noted, since 49 % listed a similar ratio of publications in mainstream, Latin American and local (Mexican) journals. The research themes were primarily in the areas of microbiology, ecology, immunology, biotechnology, neurology, endocrinology, genetics, pharmacology and public health. The numbers of papers published only in international (mainstream) journals, reached 14 %. They dealt specifically with basic sciences in the areas of molecular biology, toxicology, neurology, biochemistry, immunology, physiology, endocrinology, biophysics and immunology. 12 % of publications appeared exclusively in Mexican journals. These dealt mainly with applied research, with findings specific to Mexico for example, public health, agronomy, tropical biology, botany, epidemiology and animal production. The remaining publications were distributed among Mexican, Latin-American and international journals. It has to be noted that less publication was reported in abstracts of congresses and seminars. Around 20 books resulted from an active participation in consulting activities with international organizations (UNESCO, FAO, UN, EC, WHO), and there were some links with industry. Some editing was also reported, along with publication of encyclopedias and teaching materials, some of them treating scientific policy. There was a significant amount of translation into Spanish of work that was previously published in the researchers’ native language. Another significant finding is the diffusion of the work, at first in international journals, then in the 80s the trend was toward the local Mexican journals, and by the end of the decade publication in international journals increased once again. Most of the foreign scientists in Mexico began publishing in local journals in the 80s, indicating a commitment to start their integration in the Mexican community.

Discussion

The circulation of scientists among countries has been an important component in the transfer of scientific knowledge and scientific activity at the international level [15]. At the same time, this situation has originated and motivated the migration of researchers.

The brain drain of scientists from developing toward developed countries is indicative of an urgent problem of instability in a scientific community. On the other hand, it is an indication of the freedom of scientists in their quest for creativity and the exploration of the unknown. From another point of view the host country that opens its doors to these foreign scientists does not replace those who have left, but welcomes new participants in the establishment and development of the local scientific community.

The principal reasons that motivate this migration of the periphery to the central countries are lack of economic resources, infrastructure and material, and bureaucracy, with its evaluations, its insufficient salaries and its lack of encouragement for beginners in science [16].

Nevertheless, what motivates a scientist to come to a country that is developing scientifically, with social and political problems, and where research and development in science and technology does not receive adequate support ?

Mexico is a rich country with a magnificent cultural tradition, where the human and social sciences are of great interest to scientists of other countries, especially those from developed countries, who are attracted toward research that can only be conducted in Mexico. They must abandon their country of origin and start a “new career”, in the host country. This was observed in the group of 128 scientists working in the Life Sciences who came mainly from Eastern European countries. Their career was interrupted, but they adapted rapidly, not only socially but in the development of their research activity and its integration in a new scientific community.

The growing productivity and the equilibrium in publications with different levels of diffusion is testament to the quality of local research. The multiple coauthorships are also significant, showing a dynamic collaboration at institutional, national, regional and international levels. The coauthorship of papers has become a generalized phenomenon in recent years [17]. The participation of scientists of foreign origin in multiple activities, such as national and international consulting, their interest in teaching and scientific policy, shows a commitment towards the country, a wish to contribute and share knowledge with their colleagues, and to offer research training, but above all, a will to integrate.

The diffusion of research results through journals of different characteristics, suggests the same tendency observed in a preceding work [18]. Findings of basic research tend to be published more in international journals, while applied research tends to be published in national ones. The production figures of foreign scientists residing in Mexico suggest an average per researcher in Life Sciences of 30 papers over an 11 year period (1980-1990). The average extracted from the Science Citation Index (SCI) database, in the same discipline for the same period, but in this case the total number of papers published by Mexican scientists [19], is 2 per scientist. The comparison of these two averages, allows us to make the following comments :

a) The information on scientific production by foreigners in the SNI database, goes beyond the information available through SCI.
b) If we take into account that the SNI makes no difference between foreigners and nationals, the production average reported by the SCI should be approximately the same.
c) The scientific production not listed in the SCI covers local (national) and regional (Latin-American) publications, since SCI only includes international journals.

According to this, a research project for an in-depth study on production that is not represented in the SCI, but is registered in the SNI would be interesting. It could serve to determine true scientific activity, not only in one field, but in all disciplines covered by the SNI.

We can conclude that the compact disc of Mexico’s System of National Researchers (Sistema Nacional de Investigadores - SNI) was useful to the present study, but incomplete records must be completed before a specific work can be undertaken. The identification of institutions or complete information on the researchers, like the place of birth, and the reasons for migration, which are considered personal questions, in most cases require different investigative protocols to investigate or is simply information that is not regularly offered. The quantitative production of the studied scientists is valuable as an indicator and the SNI database can be expected to be used in the future as a source of information useful for evaluating the scientific activity of researchers in Mexico, since it covers all kinds of publications, information that is not available from other sources.

As a starting point for this exploratory study the SNI information was valuable for the initially

established objective : the identification of scientists of foreign origin in Mexico. The results are useful as an indicator of the scientific production of these researchers and as a way to appreciate and give a different perception of the analysis on scientific migration, recognizing that foreign researchers can represent a real “brain gain” for a country, Mexico in this case, and its scientific community.

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“Brain gain” en la comunidad científica mexicana : una mirada alternativa

Nora Narvaez-Berthelemot

Angélica María Rosas

Introducción

El éxito de los científicos de países en desarrollo en el extranjero es motivo de satisfacción y orgullo para sus colegas, amigos y familiares en su país natal. El premio Nobel de Química 1995 se otorgó a un grupo de investigadores de una institución norteamericana, entre los cuales figura un prestigiado científico de origen mexicano. Este hombre nació y estudió parte de su carrera en México. El resto de sus estudios, y todos sus trabajos científicos originales, han sido realizados, hasta hoy, en el extranjero. ¿Se le puede considerar entonces como un “científico mexicano”? ¿Es relevante si este investigador está o no nacionalizado norteamericano? Lo importante es que su compromiso profesional, hasta la fecha, no ha sido con México sino con Estados Unidos. De igual manera ocurre con los científicos nacidos en otros países que hace años se trasladaron a vivir a México, u otro país como este, a veces, después de años de estudios y de haber trabajado en otras partes, finalmente llegaron a un determinado sitio para instalarse y sembrar raíces en una tierra nueva. Estos investigadores inmigrantes se identifican con los problemas y las necesidades de su nuevo país, trabajan y lo hacen hombro a hombro con los locales. Su producción científica y la transmisión de conocimientos que logran favorecen a la comunidad de su país adoptivo [1]. Por ejemplo, los tres merecedores del Premio Nacional de Ciencias en 1995, nacieron lejos de México, pero desde hace varios años se encuentran integrados a los problemas, necesidades y aspiraciones de su país actual de residencia y han hecho contribuciones originales. Además, en el momento de publicar, se les considera de antemano como mexicanos, ya que su producción científica es cuantificada de acuerdo a la afiliación institucional a la que pertenecen. Es verdad que en un mundo sin fronteras podría argumentarse que si un científico emigra, la pérdida de un país es la ganancia de otro [2]. Para contrarrestar la fuga de cerebros, una tendencia marcada desde 1982, en México se han tomado medidas que comprenden, entre otras, la repatriación de talentos fugados y la acción activa del gobierno de invitar investigadores y especialistas de la ex Unión Soviética para trabajar en universidades e institutos nacionales de investigación debido a sus excelentes cualidades y modestos requerimientos [3].

Esta situación sin embargo no es nueva, cuando en 1940 como consecuencia de la guerra se vieron interrumpidas las actividades centradas en Europa se exploraron, por parte de la Fundación Rockefeller, oportunidades en América Latina. Se empezó entonces a determinar qué investigadores norteamericanos podrían trabajar acá y qué facilidades y oportunidades se presentaban en la región en el área de las ciencias naturales [4].

Dada esta situación, surgen varias preguntas : ¿Es representativa la participación de estos investigadores inmigrantes en el desarrollo científico de un país? ¿Cuál es el porcentaje de investigadores extranjeros en México? ¿Cuál es su participación en la producción de artículos científicos en un período determinado? ¿De qué países son originarios y cuál es ahora su desempeño en otro país?

Metodología

Para identificar a los investigadores que trabajan en México pero que su lugar de origen es otro país, se utilizó como fuente el disco compacto de la base de datos del SNI editado en 1993.

El Sistema Nacional de Investigadores (SNI), fue creado en 1984 con el fin de alentar la investigación y estimular a los investigadores de calidad notable, así como a los que se inician en la carrera de investigación. También busca incrementar la productividad en áreas y sectores cuyo desarrollo representa un factor importante para lograr el avance económico y social del país.

El disco compacto es un producto propio del SNI, el cual contiene 3,937 registros, que son sus miembros vigentes a 1993 y que representan el sector de más alto nivel de la sociedad científica mexicana. No contiene los candidatos al SNI [5], los cuales correspondían en 1993 a 2,274 [6]. Incluye, además de los nombres, los datos y desarrollos bibliográficos publicados e información relevante de cada uno. Con el disco compacto, el SNI cumple con la función de promover la ciencia mexicana en todos los niveles, poniendo a su disposición información valiosa sobre el aparato científico nacional. Por lo tanto, puede considerarse a esta base de datos como la única fuente formal de consulta que permite contar con una muestra controlada de la comunidad científica en México.

Para los propósitos del presente estudio fue necesario transferir todos los registros a una base de datos aparte, para poder codificarlos y analizarlos. Cada registro se identificó mediante la asignación de códigos con la siguiente información :

Sexo : Información no contenida en el disco compacto del SNI, por lo que fue necesario verificar cada registro para su identificación, en aquellos con nombres extranjeros no fácilmente identificables en español, fue necesario contactar al investigador mismo para su aclaración, asignando a cada registro F = Femenino, M = Masculino, según el caso.
Lugar de origen : Se tomaron los datos registrados en "lugar de nacimiento" (E = Extranjero, M = Mexicanos), en este caso tampoco estaban identificados todos los registros en la base original del SNI, por lo que también fue necesario solicitar una aclaración directa con el investigador.
Localidad : Este rubro fue solamente para los registros identificados de investigadores con lugar de nacimiento diferentes a México. Se les asignó su ubicación geográfica dentro de la República Mexicana. Para completar la información se utilizó también el Catálogo de Instituciones registradas en la base de datos Bibliografía Latinoamericana (edición 1993) y comparada con el directorio del SNI publicado en 1991.
Disciplina : Se codificó sólo para los registros que figuraban con lugar de origen no-mexicano. La base de datos del SNI, trae su clasificación de disciplinas propia, la cual cuenta con 41 códigos : administración, agronomía, antropología astronomía, arquitectura, biblioteconomía y archivonomía, biología, ciencias de la salud, ciencia política y administración pública, contabilidad, demografía, derecho y jurisprudencia, economía, educación, farmacia, física, geofísica, filosofía, geografía, geología, historia, información, ingeniería aeronáutica, ingeniería civil, ingeniería de comunicaciones, electrónica y control, ingeniería eléctrica, ingeniería industrial, (marina y portuaria), ingeniería mecánica, ingeniería minera, ingeniería nuclear, ingeniería petrolera, ingeniería química, ingeniería textil, lingüística, literatura, filología y bellas artes, medicina, medicina veterinaria, odontología, pesca, psicología, sociología, zootecnia.

Para el presente estudio se reagruparon estas 41 disciplinas en nueve grandes campos. Ocho grupos en ciencia y tecnología, según la clasificación de Computer Horizons Inc. [7], y uno para las ciencias y humanidades, no incluidas en la clasificación de CHI pero distribuidas en dos grupos en el este estudio : Medicina Clínica, Biomedicina y Biología, agrupado posteriormente en uno sólo (Ciencias de la Vida), Tierra y Espacio, Ingeniería y Tecnología, Química, Física, Matemáticas y finalmente Ciencias Sociales y Humanidades.

Una vez identificados y codificados los registros de los investigadores de origen extranjero, se agruparon los identificados en las disciplinas Medicina Clínica, Biomedicina y Biología, teniendo en cuenta que 60 % de los artículos científicos publicados por los investigadores latinoamericanos, solos o en colaboración con colegas extranjeros, tratan sobre el tema de Ciencias de la Vida [8]. En el caso preciso de México representaban el 75 % de su producción total de 1968 a 1970 [9], y 58.3 % durante 1980 a 1990 [10].

Se tomaron estos registros representativos para un estudio a nivel micro, donde cada nombre de los investigadores en esta disciplina, fue revisado uno a uno directamente en la base del SNI bajo la rúbrica "Producción Científica". Se cuantificó la producción y su distribución desde la fecha de publicación del primer artículo en 1941 hasta 1990, correspondiente al grupo de los investigadores de origen extranjero en el área de ciencias de la vida. Para la década de los 90 se hace una previsión por tres años (91-92-93), teniendo en cuenta el desfase que existe entre la publicación y la entrega de la información por parte de los investigadores al SNI. Esta información contiene la producción declarada por los investigadores para 1991, 1992 y 1993, mas la información declarada sin año, con la mención : "artículos en revisión", "por publicar", "en preparación".

De esta manera se cuantificó la producción de cada investigador y su trayectoria y prácticas de publicación a través del tiempo. Esta revisión detallada nos proporcionaba una representación de los artículos científicos publicados a nivel nacional, latinoamericano e internacional que tienen los científicos no mexicanos con respecto a sus colegas nacionales. La rúbrica de producción científica nos permitió también observar el nivel de colaboración, por medio de las co-autorías de cada publicación.

Se debe aclarar sin embargo que, debido al desfase en el tratamiento de la información entregada por el investigador, las prácticas de publicación y al proceso de sistematización que un método relativamente nuevo como el CD-ROM del SNI requiere, las cifras obtenidas como resultado en la producción de artículos no se tomaron como absolutas y exhaustivas en el presente estudio, sino como una tendencia y un indicador de la actividad de investigación en un grupo determinado.

Resultados

El disco compacto del Sistema Nacional de Investigadores (SNI) de México, editado en 1993, cuenta con 3,937 [11] registros, vigentes a ese mismo año, correspondientes a los investigadores miembros.

De éstos, 250 (6 %) no fueron posibles de identificar, de los restantes 3687 registros se lograron detectar 544 (15 %) de investigadores de origen extranjero, esta cifra es la utilizada en el presente estudio.

Del total (544) de registros de investigadores de origen extranjero, 393 (72 %) corresponden a hombres y 151 (28 %) a mujeres (Figura 1). Se observa una tendencia similar si comparamos estos datos con los indicadores del CONACYT/SEP [12], donde 77 % corresponde a hombres y 23 % a mujeres en el total de miembros del SNI el mismo año. Esta tendencia no es la misma cuando comparamos su ubicación geográfica en el país. De los 544 investigadores de origen extranjero, 422 (78 %) trabajan en la capital y 122 (22 %) en la provincia (Figura 1), en los datos del CONACYT/SEP [13] son 59 % del total los que están en el primer caso y 41 % en el segundo, lo que indica que los investigadores de origen extranjero se encuentran centralizados en su mayoría en universidades e institutos de investigación de la capital de la república mexicana.

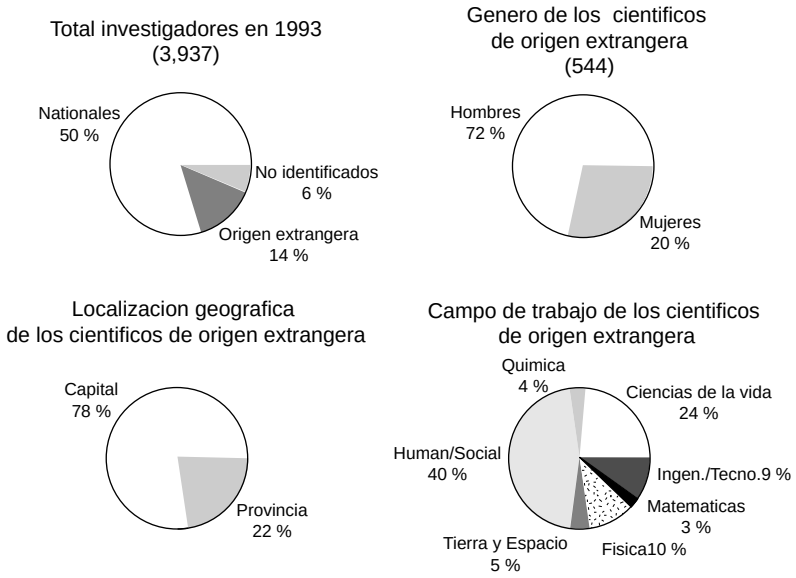


Figura 1. Investigadores de origen extrangero en el Sistema Nacional de Investigadores, 1993

El Cuadro 1 muestra los 56 países de origen de 540 investigadores. Cuatro de ellos reportaron su origen como extranjero sin dar a conocer el país. Aunque se trató de sondear el motivo para residir en México y abandonar su país de origen, en el momento de comunicarse con ellos para completar la información, algunos investigadores respondieron “por motivos personales”, sin aclarar al respecto, otros prefirieron no contestar aludiendo la ausencia de un conducto oficial.

Cuadro 1. Distribución por país de origen de los científicos extranjeros residentes en México, 1993
Fuente : CD-ROM Sistema Nacional de Investigadores, 1993.

País	Número de personas	País	Número de personas
Estados Unidos	69	Cuba	3
Argentina	68	Holanda	3
España	56	Israel	3
Chile	39	Nicaragua	3
Polania	29	Yugoslavia	3
Francia	22	Austria	2
Alemania	21	Costa Rica	2
Italia	19	Dinamarca	2
Colombia	16	Honduras	2
Guatemala	16	Hungría	2
India	15	Irán	2
Inglaterra	15	Marruecos	2
Perú	13	Rumania	2
Uruguay	11	Suecia	2
Bélgica	9	Turquía	2
Japón	9	Ucrania	2
Brazil	8	Afganistán	1
Rusia	8	África	1
Checoslovaquia	7	Argelia	1
Suiza	6	Chipre	1
Venezuela	6	Corea	1
China	5	Grecia	1
Ecuador	4	Haití	1
El Salvador	4	Paraguay	1
Puerto Rico	4	Portugal	1
República Dominicana	4	Senegal	1
Bolivia	3	Zambia	1
Bulgaria	3	Extranjeros (reportados)	4
Canadá	3		
Total	492	Total	52

En la Figura 1 se observan también las disciplinas de trabajo de los investigadores de origen

extranjero residentes en México, en su mayoría dedicados a las Ciencias Sociales y Humanidades, 248 registros (46 %), seguidos por el área de Ciencias de la Vida con 128 (24 %).

El Cuadro 2 muestra una comparación con los indicadores de CONACYT/SEP [14] de 1993, con respecto a la distribución en las áreas de investigación. Aún cuando existe un equilibrio repartido con un ligero énfasis en las Ciencias Biológicas, Biomédicas y Químicas en el área de trabajo del total de los investigadores del SNI, es remarcable la inclinación hacia las Ciencias Sociales y Humanidades como disciplina en los de origen extranjero, donde se alcanza casi 50 %, además de la baja representación en el área de Ingeniería y Tecnología cuando se compara con la total en el área.

Cuadro 2. Distribución de disciplinas de las áreas de trabajo de los investigadores del SNI, 1993

*Indicadores 1993, CONACYT/SEP

Área	Investigadores total* (3,959)	Investigadores de origen extranjero** (544)
Ciencas biológicas, boimédicas, químicas	1,223 (31%)	174 (32%)
Ingeniería y tecnología	954 (24%)	51 (9%)
Ciencas fisico-matemáticas	705 (18%)	71 (13%)
Ciencas sociales y humanidades	1,077 (27%)	248 (46%)

**CD-ROM Sistema Nacional de Investigadores, 1993

De acuerdo a la metodología establecida, se agruparon Medicina Clínica, Biomedicina y Biología en el área de Ciencias de la Vida, resultando un total de 128 investigadores de origen extranjero trabajando en esta área. Este micro estudio permitió cuantificar su producción. La distribución de las publicaciones durante cinco décadas, y una proyección por los tres primeros años de los 90. Muestra el crecimientos del número de publicaciones si comparamos los tres primeros años de las tres últimas décadas. Los de los 80 triplicaron la producción de los 70, y para los tres primeros años de los 90 la proyección es seis veces mayor que lo publicado en los 70 y duplica la de los 80.

Se observó también que, entre estos investigadores, la co-autoría de las publicaciones aumentó cada año entre 1941 y 1990, lo cual es significativo ya que alcanzó un 83 %.

Destaca el equilibrio en las prácticas de publicación, ya que en 40 % del total de éstas, se enlistaba un número similar de publicaciones en revistas de cobertura internacional (llamadas "mainstream"), latinoamericanas y locales (mexicanas). Los temas trataban, sobre todo, de microbiología, ecología, inmunología, biotecnología, neurología, endocrinología, genética, farmacología, y salud publica.

En cuanto a artículos publicados solamente en revistas internacionales ("mainstream"), éstos fueron 14 %. Referidos mas que nada a ciencias fundamentales en áreas como biología molecular, toxicología, neurobiología, bioquímica, inmunología, fisiología, endocrinología, biofísica, e inmunología.

En revistas puramente locales, se encontraron 12 % de publicaciones en solamente mexicanas. Básicamente de trabajos dirigidos hacia la investigación aplicada, con resultados enfocados directamente al país. Por ejemplo salud publica, agronomía, biología tropical, botánica, epidemiología, y producción animal.

El porcentaje restante muestra variación, hay participación diversa de las publicaciones en revistas mexicanas, latinoamericanas e internacionales.

Cabe destacar que se reportó poca publicación en memorias de congresos y seminarios. Se detectaron alrededor de 20 libros y una participación en actividades de consultoría con organismos internacionales (UNESCO, FAO, NU, CE. OMS), y algunos con la industria. Se reportaron trabajos de edición, de publicación de enciclopedias y material para la docencia y algunos tratando política científica. Cabe destacar la tendencia de traducir al español trabajos que fueron publicados en la lengua materna del investigador al inicio de su carrera, en su país de origen.

Otro aspecto para resaltar, es la difusión de trabajos, en los primeros años, en revistas internacionales, en los años 80 la tendencia es en revistas locales mexicanas y hacia el final de esa década se renueva la publicación en revistas internacionales.

Es en esos años cuando se empieza a publicar principalmente en revistas locales, lo que indica que es en esa época que se percibe la integración de la mayoría de los investigadores de origen extranjero en México.

Discusión

La circulación de investigadores entre países ha sido un componente importante en la transferencia del conocimiento científico y formas de actividad a nivel internacional [15]. Al mismo tiempo, esta situación ha originado y motivado la migración de científicos.

La fuga de cerebros de países en desarrollo hacia otros más desarrollados es una prueba candente de la inestabilidad de una comunidad científica. Por otra parte, también es signo de la libertad que poseen los investigadores científicos a la creatividad y a la libre exploración de lo desconocido. Desde otro punto de vista, en el país huésped se les han abierto las puertas a investigadores extranjeros que no reemplazan a los que se han ido, pero que forman parte del desarrollo y del establecimiento de la comunidad científica local.

Las causas principales que ocasionan esta migración de la periferia a los países centro, son : la escasez de recursos económicos, de infraestructura y material de trabajo ; la burocracia, donde están implícitas las evaluaciones, los salarios deficientes y los pocos estímulos para los investigadores principiantes, además de las llamadas "grillas" que crean vínculos, feudos o "capillas" que amparan o desfavorecen académicamente a un investigador [16].

Sin embargo, ¿qué motiva a un investigador a instalarse en un país en desarrollo científico, con problemas de orden social y político, y donde la investigación y el desarrollo en ciencia y tecnología no cuenta con el apoyo adecuado para su realización ?

México es un país rico en tradición cultural, donde las ciencias sociales y humanas son tema de gran interés para investigadores de otros países especialmente los desarrollados, que son atraídos voluntariamente hacia una investigación que sólo se encuentra y se puede desarrollar en un terreno específico. Existe también la necesidad de abandonar el país de origen, y comenzar una "nueva carrera", si se puede decir así, en el país receptor. Esto se observó sobre todo con los investigadores procedentes de los países de Europa Oriental, del grupo estudiado, conformado por los 128 trabajando en Ciencias de la Vida, su carrera se vio interrumpida, pero mostraron una adaptación rápida no solamente social sino en el desarrollo y en la dinámica de una actividad de investigación integrada a una nueva comunidad.

La productividad creciente y el equilibrio en la publicación utilizando varios niveles de difusión, es un ejemplo de la valorización a la investigación local, extensiva a la región. Las co-autorías múltiples también fueron relevantes en el presente estudio, mostrando una dinámica de colaboración a nivel institucional, nacional, regional e internacional. La co-autoría de artículos se ha vuelto un fenómeno generalizado en los últimos años, lo cual ha sido observado también como una tendencia [17].

La participación de los investigadores de origen extranjero en actividades múltiples, como asesorías nacionales e internacionales, así como el interés en la docencia y en estudios paralelos sobre política científica, demuestran un compromiso hacia el país, un deseo de aportar y compartir conocimientos a nivel de sus pares, de formación para la investigación, pero sobre todo, una voluntad de integración.

La difusión de la investigación por intermedio de revistas de diferentes características, sugiere la misma tendencia observada en un trabajo precedente [18], los resultados relacionados con áreas de investigación básica, tienden a publicarse más en revistas de cobertura internacional, mientras que los de investigación aplicada tienden a aparecer en las nacionales.

Las cifras de producción de los científicos extranjeros radicados en México, sugieren que el promedio por investigador en Ciencias de la Vida, durante un período de 11 años (1980-1990), es de 30 artículos. El promedio extraído de la base de datos del Science Citation Index (SCI), en las mismas disciplinas, por el mismo período, pero en este caso de la totalidad de los artículos de los científicos de México [19], es de 2 por investigador. La comparación de estos dos promedios nos permite sugerir las siguientes reflexiones :

a) La producción de los extranjeros, según el SNI, va mucho mas allá de los artículos enlistados por el SCI.
b) Si se toma en cuenta que el SNI no hace diferencia alguna entre los extranjeros y los nacionales, la producción no reportada en el SCI debe ser del mismo nivel promedio.
c) La producción científica no enlistada por el SCI es de cobertura local (nacional) y regional (latinoamericana), ya que éste sólo incluye revistas internacionales donde las latinoamericanas no tienen gran representación.

Teniendo en cuenta lo anterior, se abre la investigación hacia un estudio más a fondo sobre la producción que no está representa en SCI, pero que se encuentra registrada en el SNI, con el objetivo de determinar la actividad científica real, no solamente en un área determinada sino en todas las disciplinas del conocimiento cubiertas por SNI.

Podemos concluir que el disco compacto del Sistema Nacional de Investigadores fue de utilidad para el presente estudio, sin embargo, existen todavía vacíos dentro de los registros que se deben llenar si se quiere llevar a cabo un trabajo específico. La identificación de instituciones o de la información completa por parte de los investigadores, como el lugar de nacimiento o la motivación para emigrar, son preguntas consideradas personales, que la mayoría de las veces necesitan un protocolo diferente para investigar o que simplemente es información que no se ofrece. En cuanto a la producción cuantitativa de los investigadores estudiados, ésta fue valiosa como indicador, la expectativa para utilizar en el futuro la base del SNI como fuente de información para evaluar la actividad científica de los investigadores en México, promete ser de gran relevancia, ya que cubre todo tipo de publicaciones que actualmente no es visible utilizando otras fuentes de información.

Como punto de partida para el presente estudio exploratorio, la información del SNI fue valiosa, para el objetivo inicialmente establecido que fue identificar a los investigadores de origen extranjero en México. Los resultados sirvieron como indicador de la productividad científica de éstos y como medio para valorar y dar una percepción diferente a los análisis sobre migración científica, reconociendo que investigadores extranjeros pueden representar para un país y su comunidad científica, la mexicana en este caso específico, un real "brain gain".

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Implications of Scientific Mobility between France and the United States

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Dominique Martin-Rovet

Scientists do not cease moving from one country to another. The origin of these reciprocal and simultaneous movements lies in relative and subjective (in the better sense of the term) but nevertheless pertinent judgments. If we want to study mobility using the concepts of the center and the periphery, we realize that the very notion of relativity must be introduced in the analysis. A scientific “ center ” is just the place to which scientists are attracted and that they perceive thus as a center. This perception may depend on different factors : discipline and subdiscipline, language, state of advancement of the scientist’s career, research objectives, marginality or non marginality of the scientist.... Even in the post-war roaring years, when science in America was developing exponentially, extraordinarily faster than anywhere else, in certain cases, there were reasons to move to Europe, to study there a specific discipline, or to work. Ever since, European science has come from behind, taking an *avant-garde* position in many field [1] and the notion of the center has become more and more elastic. Since in science a center exists as it is perceived it is quite obvious that American science is still its center judging from the significant number of Frenchmen that continue to go to the United States to study there while only a small number of Americans that travel the other way around. Centers maintain high quality standards, gather resources, and can offer scientific training, access to equipment and references useful to scientists and peripheral groups.

Center of what?

A study of scientist’s mobility shows that it is not a monolithic entity : there is no such a thing as a unique center which attracts all the pilgrims, it is rather a fragmented, diverse and eccentric complex. Centers of science are not concentric, and the directions of movement many. The size, complexity and weight of socio-economic structures increasingly force them to rely on science to solve the problems of these structures. We look to investments in science to produce real benefits. As a result, policy-making centers, whose natural tendency is to keep heavy economic structures, exert an increasing attraction on cultural and intellectual life. The fact that science tries to oppose to this sort of right of pre-emption shows the importance of freedom of research, and undoubtedly of the still very important role of individuals in its orientation, despite the emergence of large scientific projects, super groups and increasingly complex budgetary policies.

The influence of scientific policy on science, especially in its center must not be underestimated : with its increasingly higher costs, science is today more close tied to other aspects of central policy. As a result, centers of science are hard different than those of society. An example of this amalgam may be seen in the recent tendency of scientific research in America to coincide with the objective of global economic activity and centralism.[2] If the only remaining ele-

ments of a central domination are the financial interest and the keeping of economic stability, then centralization confines itself to considering every activity from the point of view of profitability, over increasingly shorter periods of time. The budgetary pressures that this creates do nothing but reinforce the tendency to have conservative, risk free research programs and, consequently, freedom to undertake research is reduced to that of continuing a particular research, for financial reasons. Centralization, in this sense of the term, is a force that has enormous influence on scientific research, an activity that, by its nature, is individual and non-programmable. The notion of a scientific center is a double-edged one, since this center may constitute a source of power and dynamism, but also of opposition to progress. Thus, it is not surprising that scientific mobility is being influenced by these ambiguities. The quest for completely free research may lead in many directions, sometimes even in opposition.

Through the examination of what makes scientific mobility and exchange so important, we can understand why plurality is being threatened. If the centralization of scientific activity goes on and leads to conservative science, oriented and controlled by policy makers with purely economic objectives, then the name of the threat is uniformity. Science must be one and universal : that is one of the principles of what could be called the ideology of science. Unfortunately, all studies on the work of scientists show that it is not so simple ; in many cases, numerous aspects of scientific culture, such as choice of subject, theoretical and methodological approach, are a matter of local decisions. This is what largely explains the great mobility. Thus, young American physicists have been happily surprised at seeing how problems that were quite familiar to them were dealt with by their French colleagues in ways to which they were unaccustomed. In turn, French scientists were surprised at the Americans' extremely pragmatic attitude and their ability to repair, for example, equipment out of service. But as science anthropologists have revealed, this type of difference can also be observed in two different laboratories of the same country. Thanks to personal contacts in the laboratory environment, ideas, traditions and innovations, never mentioned in scientific literature, are developed. If we consider exchange as a principal element of science, then universality would be a source of entropy.

This assertion is exposed in an old publication by R.E. Park. It deals with intellectual migration, with the importance of its local environment and with cultural background of intellectual migrant.[3] According to Park, when mobility becomes migration, or when migration, scientific migration, for example, is due to other reasons, cultural shock may liberate a considerable amount of energy. Almost all scientists have stated how working with people whose way of thinking was different was a stimulus for their own research. Americans have mentioned the quality of the host team as being, by far, the main advantage of their staying in a French laboratory. It is precisely this point, a stimulating environment, which has been the determining factor for Americans permanently installed in France, when compared to the advantages they would have obtained in the United States, such as a more rapid progress in their career, and a higher salary. On the other hand, young French post-doctoral researchers have been amazed with the richness of the constant discussion within and among American university laboratories. In his work on science, J. Ziman emphasizes the cultural aspect of science and the role played by ideas on a global scale to stimulate scientific creativity.[4] Paradoxically, a global point of view is nearly always conditioned by its local or cultural origin [5]. Scientists speak of the need of " opening their laboratory windows ", that is relocating their work to a broader intellectual environment, that takes into account the relations between their specific research ideas and the great problems of science, scientific policies and societ [6] . A recent editorial in Nature, in which science was defended against a certain anti-science, called for " a description of its significance for the world... in order to recognize its own identity " [7].

The Center of Scientific Policy

Unfortunately, scientific policies show little interest in this sort of preoccupation. As a conclusion, the author of the above-mentioned article thinks that the aim of science is “ improving knowledge ”, a definition hardly taken into account by policy makers : they rather speak in terms of material progress, social protection, applications and techniques. The objectives of international cooperation take another sense in their terms. The Europe of sciences aims at uniting its efforts and thus advancing faster along the same path ; scientists executors, both in the United States and in Europe, are more concerned with not lagging behind, and staying on the leading team, rather than enriching the scientific community through new perspectives. Thus, if such homogenization is taken too far, it can be feared that European Union countries will lose their scientific trump cards [8].

According to some analysts, scientists are, in general, conservative in nature, hardly inclined to marginality, divergence or radical changes. Another source of concentration may lie in the lack of personnel as scientists converge towards the center [9]. If we add to this the influence of large projects, it should not be surprising that young American researchers complain of having to handle the system before even learning the basics [10]. As for French researchers, they are stimulated by the dynamism of science at the center and some, once they are inside, by to recreate this dynamism and to play the role of vectors of dissemination in a certain form of science.

Nevertheless, a more detailed study on the center-periphery dynamics of mobility reveals its complexity and diversity. In fact, this mobility might be seen as a tool for the benefit of the scientist’s career : it may reinforce the scientist’s influence at the center, in a conservative way, or it may, on the contrary, reinforce the emergence of marginal ideas and centrifugal forces. The mere difference between two important scientific poles such as France and the United States, even if it only refers to central organizations, may also curtail the conservative forces that the scientist finds in his initial environment. Mobility is thus a mean to progress in a career, be it “ conservative ” or not. In Europe, where mobility is more developed than in the United States, it becomes at the same time a tool and a scientific policy goal, especially at the European Union level ; this is not yet the case in the United States, where the acceptance of foreign scientific labor remains a passive phenomenon.

The complexity of “ perceived ” centers and peripheries

Even if the existence of an objective center may be questioned, mobility is still an attraction for French scientists, due to America’s reputation of being a scientific center. There is often a convergence of the perception of the center and the presence of financing. But what can be said of rich Texan universities that -thanks to oil- “ buy ” at Cambridge renowned scientists ? They confirm the notion of “ perceived center ”, and establish rival centers on peripheral sites. Mutual attraction between French sociologists and the most important American universities may also be mentioned. For these famous intellectuals, America is a center characterized by high salaries and a well appreciated life style. It must not be forgotten, however, that, along with their luggage, they take with them the long cultural tradition of European centers. Where then is the periphery located ?

It would be useful to determine why the French are inclined to get an education in America. We

have found that even though they all came from good institutions, not all candidates to a Ph.D. and post-doctorate researchers had graduated from the “ Renowned schools ”. According to the interviews we have conducted, many of them come to the United States to obtain a supplementary trump card in their career. A center defines its own standards of education, and will not be an “ absolute center ” if it does not attract the best candidates. In fact, it seems that valuable young French scientists go to the United States to acquire a certain type of education, where research is combined with teaching, a method which is far more practiced there than it is in Europe. Although they are impressed by the dynamism of the university environment, they are less impressed by the scientific level of their American homologues, particularly in mathematics.

A more precise image of young “ periphery ” scientists looking for a “ center type ” education can be drawn by listening to comments from young American scientists on the education they find in France. Most of them have been surprised at the students high level of knowledge, and, generally, a high point of their experience is the quality of the host team. Interviewed on the quality of the institutions that have hosted them, they have acknowledged that the best of them ranked among the first ten American institutions. Vice versa, young French scientists characterized America as a perceived center, providing the assurance to improve their résumé ; but this was also due to the style of research practiced there, conducted at a good pace, competitive and financially motivated : America is undoubtedly the champion of this model, that fascinates young Europeans, whether or not they decide to import it to their countries.

There is still another point to make about the notion of a scientific center : that is, of course, that it varies according to the discipline being considered. While French scientists do not need to go abroad at all looking for renowned centers in mathematics or anthropology, the same does not apply, for example, to soil sciences or to chemistry. Conversely, we would like to mention an interesting anecdote : we met an American historian who, twenty years ago, due to a series of fortunate coincidences, found himself in the core of the French stronghold in his specialty, normally an unlikely situation for a “ peripheral ” scientist like him. It became the opportunity of his career, as his work profited from ten-year-old research, impossible to under take in his own country [11].

Some scientists, American or French, cross the Atlantic exclusively for reasons linked to their specialty, in quest for a particular technique or research method. For them, the center is somewhere else. The Franco-American quarrel on the discovery of the HIV virus may show, at least partially, the recentering of a domain whose pioneers were French. Likewise, alternative approaches or theories may converge in a given environment ; thus, in the economic sciences, France has become somewhat of a center of peripheral approaches. For example, in disciplines such as linguistics, physics or epistemology, that is the reason that has prompted certain American scientists to settle in definitely in France.

It must not be forgotten that countries with different scientific weight are not arranged in a concentric manner. Thus, mobility between developing countries and Europe does not have the same configuration as does mobility between Europe and the centers’ center, that is, America. African scientists come to France to find an environment which is undoubtedly superior to theirs ; however, this does not apply to post-doctorate French researchers who go to the United States. Algerian scientists look to France as a center as far as science is concerned, while French scientists go to the United States looking for equipment, communication and dynamism, suitable complements for what they have in their own country. Mobility between Algeria and France is only one-way, while it works both ways between France and the United States, as it does between specific centers or micro-centers, even if the exchanges are unequal in volume.

However, the limited flow of American scientists to important French centers is not due to the scarcity of such centers. The dynamics of the center-periphery flow appears complicated when

we consider a country like India, a nation with economic development, but with first-rate scientific facilities : nevertheless, its future head scientists keep on coming to Western countries to get a promotion [12].

Mobility between secondary centers provides as much benefit as a stay in the United States does. A Center may also become a sort of a dead weight ; an international scientific Community only remains active if it becomes attractive to more secondary centers. Because of the great progress made by European science America's attraction has diminished, which has made mobility more intra-European. In other words, the attraction exerted by the United States has somewhat declined as a result of considerations such as distance and cost. There are, then, a number of movements between centers that take place in the classical center-periphery context, and at a domestic level, which is confirmed by classical studies on mobility based on domestic statistics. It is interesting to go into our research more deeply by examining the relation between scientific plurality and distance. The latter, indeed, plays a more important role in Europe than it does in America. Examination of mobility vectors would allow us to identify sub-regions of preferred mobility, including mobility beyond frontiers. A cartography of the phenomenon would certainly show two types of mobility, both good, incidentally : one of them reinforces links and common points within a region, in the center or in the pole ; the other one fosters inter-regional exchanges and contacts and encourages diversity. In Europe, the promotion of this mobility matches well with the region's will to strengthen its own identity. But this very idea is a real nightmare for policy makers, who fear the emergence of division and conflicts ; they forget that in science at least, diversity is a source of enrichment and not of inefficiency.

For a number of American and French researchers, scientific considerations will always be at the core of mobility, even in cases in which inter-cultural experience is a criterion for decision. An example of this is the fact that all discussions on experience is still centered on its scientific contents. And it is precisely on this point that the importance of center perception or quality perception lies, that is where one of the most important contributions of scientific mobility lies : when researchers return to their countries, the ideas and new methods they bring from their stay abroad modify behavior and perception in their own laboratories. Peripheries are not always blind alleys and mobile scientists are like scouts who contribute to changing the increasingly complex physiognomy of the world of research.

Although developing countries are beyond the scope of our study, it is interesting to include, within a larger context of scientific mobility, some considerations concerning the scientific periphery they constitute. First, it must not be forgotten that the European scientific " magnet ", taken as a model, is, in fact, nothing but a resurgence of the intellectual and cultural role that Europe has played for centuries. By being willing to massively transpose technology to the developing regions [13], one ignores that in order to guarantee success a particular cultural substratum is required [14]. In any case, Western scientific progress has its origin both in intellectual curiosity and in a real investment strategy. Moreover, centers as well as peripheries have a role to play. Though it is not necessary that each nation tries to become an independent scientific center, each must, on the other hand, develop its own cultural, intellectual and scientific potential. It is quite possible that developing countries depend on different means to reach their own goals. That is why an alignment to a central model may lead to implementation of a scientific policy inadequate for such peripheral regions. Finally, if we again place mobility and centralism in the context of an open space, it becomes clear that the periphery must not be dealt with in a centralist model. On the contrary, we perceive a great variety of local contributions, more or less important, to a mosaic of sciences and methods.

Publishing center and language used at the center

Predominance of a center is measured by the number of publications considered to be essential to a scientific career, which are then placed under the control of dominant trends in that field, at a given moment. In numerous disciplines, these journals are published in the United States. Those who select the articles may represent a college of scientists, more or less large, more or less international, but not always very “ invisible ”. Constructivists, particularly, have shown that, in terms of productivity, publication is the most important act of a scientist. Even if one does not completely agree with them, it must be acknowledged that they have been able to prove that publication is the culmination of most scientific operations [15]. Moreover, the best works are bound to be disseminated all over the world, that is to be published in international renowned journals.

Although scientists do not openly mention the possibility of publishing as being one of the reasons for their mobility, there is, nevertheless, a relation between mobility and access to journals of the highest standing. In fact, it is through contacts with and contributions to these journals, rather than through presence in symposia and seminars, that it is possible to have international collegial recognition for one’s work, particularly from Anglo-American colleagues. Thanks to mobility, scientists can diminish the distance and linguistic barriers between them and establish the best “ selling points ” for their most important work. If mobility were more frequent and followed a more uniform pattern of distribution, on the one hand, quality of scientific work would be better recognized, regardless of where it came from while, on the other hand, scientific publications would be better shared and more easily accessible. Nevertheless, as we have seen, some, particularly Americans, hardly put mobility into practice. As a consequence, the center maintains its predominance in its access to the market, a fact that is perpetrated by ignoring international science’s quality, an ignorance in which the center excels. This situation could only change with mobility coming from the center, but scientists from the center are not interested in this mobility for reasons of access to publications.

Bibliometric studies on international cooperation and the apparent internationalization of science revealed in them sometimes mask the accumulation of centripetal forces engendered by, or at least aggravated by access to literature. These studies are based, in general, on data coming from the Science Citation Index (SCI), but rarely mention the name of publications, the language in which most of the articles drafted in coordination are written or the fact that Americans, scientists from the center, are insufficiently represented in all international papers written in cooperation. An illustration of this may be seen in the analysis of the quotation indexes [16] : since scientists from the center only read journals from the center, they can only quote what they read, that is articles published in the center. Considering a period of over five years, scientific articles published by French researchers in American journals are quoted 40 % more frequently than the average French articles, and 80 % more frequently than papers published outside the United States. On the whole, non-American authors published in American journals are quoted twice as much as those published in non-American journals. Additionally, it would be interesting to analyze the nationality of the quoters and to see whether Americans quote readily their foreign colleagues.

In order to counteract the center’s effect, French scientists should make an effort to publish jointly with Americans and hence accede to American journals. As for 1988, the year we have chosen as reference year, France-American publications constituted one fourth of all Franco-foreign publications and nearly 40 % of those published in the American scientific press. In sum, a Franco-American article has 3.4 times more the chance of being published in an American magazine than does a French article, and 3.2 more chances than does a France-foreign article that does not include an American scientist.

The effect of domination due to a center's reputation can be seen in the fact that American scientific articles published abroad are quoted twice as much as the average of all articles published outside the United States. By way of comparison, we may note that the rate of quotation of American articles in American magazines was only slightly higher than that of non-American articles. Consequently, an American article loses very little of its absolute impact when published abroad, and gains much in relative impact, since the quotation relative index, that is, the quotation rate divided by the average world quotation rate, in a period of five years, increases from 1.01 to 1.60. International joint publications including Americans, in American magazines, represent only 12 % of all joint articles not having Americans as one of the authors : this reveals the power of attraction of the American scientific press. Even for a scientifically advanced nation like France, the force is so powerful that only one third of France-foreign articles not having an American joint author are published in an American magazine.

Nevertheless, although America is the capital of the scientific world, it seems to be cut from its " provinces ". If a laboratory's nationality is analyzed, it can be seen according to American journals, that American scientific production represents 73 % of the total production of G-7 nations, but only 21 % of the results are published in non-American publications. However, a comparison undertaken between the data in 1983 and in 1988 shows an increase of foreign articles in American journals : those coming from the G-6 rise from 18 % to 22 % ; on the other hand, no increase is seen in American publications abroad. As for joint articles, they demonstrate well the reality of a partially isolated center, since only 3.4 % of American articles in American Journals involve international collaboration. By way of comparison, 10 % of French scientific production includes international participation. Moreover, when American scientists publish abroad, only 8 % of those articles include international collaboration. Certainly, an isolated center can only play a secondary role in international cooperation : foreign-American articles are only 77 % of all American joint articles, compared to 26 % in France. On the other hand, not taking into account Franco-American collaboration, a result of the attraction French feel for the center, it can be seen that the latter choose foreign collaborators, hence non-Americans, 2.3 times more often than their American colleagues do.

The panorama changes greatly from one discipline to another, but this analysis is beyond the scope of our intention. However, an interesting point can be noted. Let us compare, throughout a five-year period, the relative impact, as we have defined it above, of French articles published in American magazines, and that of French production outside the United States ; from the nine categories being analysed by the SCI, the impact of four of them increases significantly when publication is done outside the United States : it rises from 0.90 to 1.40 in chemistry, from 0.95 to 1.29 in physics, from 1.00 to 1.20 in land and space sciences and from 0.88 to 1.04 in biomedical researches. On the other hand, only two of them have an increasing relative impact when the article is published in American journals : it mounts from 0.90 to 1.40 in biology and from 0.88 to 1.14 in clinical medicine. If one takes into account how the number of quotations vary according to whether or not the articles are published in the United States, these large differences from one discipline to another can be interpreted as a measure of how certain French scientific disciplines overcome the loss of impact engendered by publishing outside the United States.

The risk of the center being partial in the choice of publication, based on the country of origin, certainly worries scientists. Studies on this subject tend to ignore the process of selection and to consider only what has been published. Stephen Cole has examined closely an example of fellow scientists' judgment, the one concerning NSF budget decisions. Although he does not directly study the international milieu nor publications, his conclusion deserves to be mentioned : " luck plays an significant role in this decisions " [17]. By analogy, it can be thought that in a journal´s selection procedure merit is not the only factor being considered. The former head of INSERM (Medical Research National Institute), who was a scholar in a renowned medical school in the United States, suggested that there could be " shorter and longer rou-

tines ” in the evaluation procedures practiced in the best known journals [18]. For their part, non anglophone scientists, very active in their respective international colleges, pointed out the elimination of some articles because of minor English style defects.

As mobility makes awareness of the universal character of science become apparent, it can be a way of enhancing selection procedures in top-level international publications. No doubt a center has its own and official language. But many will affirm that English, not always very orthodox indeed, being used throughout the world by scientists, has become the “ jargon ” of researchers. And this “ jargon ” is the intermediary language allowing two scientists from the periphery, speaking different mother tongues, to understand each other. English is considered the language that suits best experimental sciences. Yet, it is important to distinguish the intermediary function of this “ jargon ” from the concept of an anglophone center [19]. Likewise, it is not unrealistic to encourage publications in languages other than English, or even polyglots [20]. Language used is all the more important since a publication is not a mere communication of results, as most bibliometric works tend to suggest. Most of them are also the scientific “ product ” in itself. A biased literature gives excessive importance to science from the center, leaving in the shade science from secondary centers or from the periphery ; this increases the concentration effect, as the notion of center depends, in a certain way, on how it is perceived. The act of using language can not be a simple transcription : it is an essential part of the discovery process. Hence polyphony becomes a factor inherent to scientific development.

Appearance and Reality

Science searches an identity that must be somewhere between the professional scientist, often recruited to meet broad national economic needs, at one end of the range, and the independent researcher, on the other end. International exchanges could help to define such identity, minimizing the aspect of a scientist “ earning his living “ and maximizing a more traditional type of research. For the constructivist, persuaded that scientific knowledge is entirely a construction, this has, undoubtedly, little importance : to him it is merely a difference in production methods. But for those who are convinced that under the garb of a scientist worried about his career a discoverer is sometimes hidden, exchanges, traveling, migration and knowledge of scientific quality abroad can furnish a great deal. For anyone describing mobility in a broad way, this contribution appears only partially because scientists’ complexity and individuality do not allow a simplistic analysis featuring a strong center, a weak periphery and clear vectors linking them.

It is true, nevertheless, that there are some mechanisms that maintain the existence of this predominance of the center that does not correspond with scientific quality and counteracts the international development of sciences. We saw this when the problem of publications was examined. It is difficult to know whether scientists’ mobility, an instrument of independence and access for everyone to a top-level science, will be able to survive both economically oriented policies and unjustified prejudices favoring the center. Traditional objectives of policy are mistaken for a dream of simplicity, or even of complete homogeneity among centers, and biases favoring them maintain a one-way mobility. This situation could lead to a gap between “ apparent ” and “ real ” centers. Such a gap already exists to a degree, but it is masked not only by the center’s apparent strength but also by the habit of considering English an intermediary language.

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[1] Brooks, H. (1989).

[2] The White House Scientific Policy Bulletin, A vision of Change, speaks of the need for a “ strategic research ” to increase American competitiveness ; this assertion is quoted in an editorial of “ Hearing for Basic Science ”, *Nature,* 367. (February 3, 1994), p 396

[3] Park, R. E. (1928).

[4] Ziman, J., (1981).

[5] A new poll tool for scientific policy used by French National Center for Scientific Research (the most important employer of State-payed scientifics) has given way to strong criticism because the poll had been copied, without modifications, from a Japanese model. Although the questions were essentially of scientific nature, their cultural contents had greatly worried scientists Cf. “ Une enquete de prospective technologique suscite une polémique parmi les chercheurs français ”, *Le Monde*, March 11, 1994, p. 12.

[6] The “ general context ” may frighten. Some scientists are openly against metaphysics, as an obstacle to science. A certain nervousness can be felt when quantification of gravity, or reduction of conscience to a solvable problem are discussed.

[7] Maddox, J., (1994).

[8] Gispert, R. (1988).

[9] Andler, M. (1990), pp. 853-855, for an example taken from mathematics.

[10] Hackett. E.J. (1990).

[11] A surprising illustration of this peripherical contribution (in history) may be found in the invitation recently made to the American historian, Robert Paxton, author of the best history ever written on Vichy, to be a speaker at the famous M. Bloch Symposium, on the commemoration of the 50th anniversary of the execution of this great historian and fighter of the “resistance”.

[12] Although worried about this brain drain, India is also a regional center of attraction, with a long tradition of excellent education. According to Unesco statistics, India ranks between the first twenty countries that host foreign students in their universities, Sweden being the first on the list ; most of these students come from South-East Asia and East Africa. Johnson in Johnson. J.M. NSF, National Science Foundation (USA), Human Resources for Science and Technology. The Asian Region, 1993, affirms that from 4.937 doctorates in natural sciences obtained in Asian countries chosen for the study (including Japan and South Korea), 3500 were awarded by Indian universities.

[13] Naaz Saharif, M. A theoretical example on transplanting science and technology.

[14] In order to appreciate how little comprehension this domain encounters, read : Dedijer, S., (1961), the author asks there for a “research ecology”, or a study of the local social environment as a subject for a scientific work.

[15] Knor-Cettina, K. D (1981).

[16] Our estimates come from bibliographic measurement data extracted from the data-base of the OST (Observatoire des Sciences et des Techniques, Paris) This data-base results from treating the Science Citation Index, which is itself the only measurement tool of this sort. The fact that it is American adds a prejudice, which stresses the center effect.

[17] Reedited in Cole, S. (1992)

[18] Interview with Philippe Lazar : Nouchy, F., “ Un entretien avec Philippe Lazar : La loi Toubon est un combat d’arriere-garde ”. *Le Monde*, June 21, 1994, p. 2

[19] Official language is not a reliable indicator of a center’s activities : Latin nomenclature does not indicate by any means that Rome is the center of botanic research !

[20] Lazar in F. Nouchy, *op cit.* He gives there a very successful example of polyglot litterature : *Medicine-Sciences*, a broadly read magazine edited in France.

Les voyages scientifiques entre la France et les États-Unis, où est le centre ?

Timothy Carlson
Dominique Martin-Rovet

Les scientifiques ne cessent de passer d'un pays à l'autre. Ces chassés-croisés résultent de jugements relatifs et, dans le meilleur sens du terme, subjectifs mais néanmoins pertinents. Pour étudier la mobilité en utilisant les concepts de centre et de périphérie, nous nous apercevons qu'il faut y introduire la même notion de relativité. Un « centre » scientifique est tout simplement le lieu où les scientifiques sont attirés, et qu'ils perçoivent donc comme un centre. Cette perception peut dépendre de plusieurs facteurs : discipline ou sous-discipline, langue, avancement dans la carrière, objectifs de recherche, marginalité ou non du scientifique... Même dans les années bouillonnantes de l'après-guerre, lorsqu'en Amérique la science se développait de façon exponentielle, infiniment plus vite que dans les autres pays, il y avait quand même matière, dans certains cas, à se rendre en Europe pour y acquérir une formation ou pour y travailler. Depuis, la science européenne a comblé son retard dans de nombreuses disciplines [1], et la notion de centre est devenue de plus en plus élastique. Puisqu'en science un centre existe tel qu'il est perçu, il est bien évident que la science américaine en est toujours le coeur, si l'on en juge par le nombre important de Français qui vont aux États-Unis pour y acquérir une formation, et le nombre restreint d'Américains qui font le chemin inverse. Les centres maintiennent des standards de qualité élevés, concentrent les ressources, et sont en mesure d'offrir formation scientifique, accès aux équipements et références, utiles aux scientifiques et aux groupes périphériques.

Le centre de quoi ?

Une étude de la mobilité scientifique montre que celle-ci ne constitue pas une entité monolithique : on n'a pas un centre unique qui attire tous les pèlerins, mais plutôt un complexe fragmenté, divers et excentrique. Les centres de la science ne sont pas concentriques, et les directions des mouvements sont multiples. La taille, la complexité et la pesanteur des structures socio-économiques les forcent de plus en plus à compter sur la science pour les débarraser de leurs maux. On attend des investissements dans la science qu'ils produisent des bénéfices concrets. Il en résulte que les centres de décision politique, dont la tendance naturelle est de maintenir des structures économiques lourdes, exercent une force d'attraction croissante sur la vie culturelle et intellectuelle. Que la science essaie de s'opposer à cette sorte de préemption est le signe de l'importance de la liberté pour la recherche, et sans doute également du rôle toujours très fort des individualités dans son orientation, malgré l'émergence des grands projets scientifiques, des super-groupes et des politiques budgétaires de plus en plus complexes.

Il ne s'agit pas de sous-estimer l'influence de la politique scientifique sur la science, spécialement sur son centre : avec des coûts toujours plus élevés, la science se trouve maintenant plus étroitement liée aux autres aspects de la politique du centre. Il en résulte que les centres de la science ne diffèrent plus guère de ceux de la société. On veut pour illustration de cet amalgame les tendances récentes de la politique de la recherche en Amérique, qui se confondent avec les objectifs d'une activité économique, globale et centralisatrice [2]. Si intérêt financier et maintien de la stabilité économique sont les seuls éléments qui demeurent d'une domination centrale, alors la centralisation se réduit à considérer toutes les activités du point de vue de la rentabilité, et ce sur des périodes de temps de plus en plus courtes. Les pressions budgétaires ainsi créées ne font que renforcer la tendance aux programmes de recherche conservateurs et sans risques, et la liberté de faire de la recherche se réduit, par financement interposé, à celle de poursuivre une recherche particulière. La centralisation, dans cette acception du terme, est une force qui pèse lourdement sur l'activité, par nature individuelle et non programmable, qu'est la recherche scientifique. La notion de centre scientifique est à double tranchant, car celui-ci peut constituer une source de puissance et de dynamisme, mais aussi d'immobilisme. Il n'est donc pas surprenant que la mobilité scientifique soit influencée par ces ambiguïtés. La quête d'une recherche en toute liberté peut conduire dans bien des directions, parfois même opposées.

L'examen de ce qui fait la valeur de la mobilité et de l'échange scientifiques, permet de comprendre pourquoi la pluralité est menacée. Si la centralisation de l'activité scientifique se poursuit et conduit à une science conservatrice, orientée et chapeautée par des décideurs aux objectifs purement économiques, alors la menace a pour nom uniformité. Que la science soit une et universelle, c'est là l'un des principes de ce que l'on pourrait appeler l'idéologie de la science. Malheureusement, toutes les études sur le travail des scientifiques montrent que ce n'est pas si simple ; de nombreux aspects de la culture scientifique, comme le choix du sujet, la méthodologie et l'approche théorique, relèvent pour beaucoup de décisions locales. C'est ce qui explique, en grande partie, la richesse de la mobilité. De jeunes physiciens américains ont ainsi été heureusement surpris de voir leurs collègues français traiter des problèmes qui leur étaient familiers, d'une manière qui leur était inhabituelle. Les scientifiques français, quant à eux, ne cachent pas leur étonnement devant l'attitude extrêmement pragmatique et la compétence plus grande des Américains à réparer, par exemple, un équipement en panne. Mais ce genre de différences, comme les anthropologistes de la science l'ont découvert, peut aussi s'observer d'un laboratoire à l'autre dans un même pays. Des idées, des traditions et des innovations jamais mentionnées dans la littérature se développent, fruits des contacts personnels dans l'environnement du laboratoire. Dans la mesure où l'échange est l'élément principal de la science, l'universalité serait source d'entropie.

Cette assertion est exposée dans une publication ancienne de R.E. Park. Il y traite de la migration intellectuelle, de l'importance de son environnement local et du bagage culturel de l'intellectuel migrant [3]. Quand la mobilité devient migration, ou quand la migration, des scientifiques par exemple, est due à d'autres raisons, le choc des cultures peut, selon Park, libérer une énergie considérable. Les scientifiques ont eux-mêmes presque tous mentionné combien le travail avec des personnes dont les modes de pensée sont différents a pu stimuler leur propre recherche. Les Américains ont cité la qualité de l'équipe d'accueil comme étant, de loin, le principal avantage retiré de leur séjour dans un laboratoire français. C'est ce dernier point, un environnement stimulant, qui a joué pour les Américains définitivement installés en France, contre l'avancement plus rapide et le salaire plus élevé dont ils auraient bénéficié aux États-Unis. De jeunes chercheurs post-doctoraux français ont été enthousiasmés, quant à eux, par la richesse des discussions constantes dans et entre les laboratoires universitaires américains.

Dans son ouvrage sur la science, J. Ziman met l'accent sur l'aspect culturel de la science et le rôle que jouent les idées à l'échelon mondial pour la créativité scientifique [4]. Paradoxalement, un point de vue mondial est presque toujours fortement conditionné par son origine locale ou culturelle [5]. Les scientifiques parlent de leur besoin d'« ouvrir les fenêtres » du laboratoire, c'est-à-dire de replacer leur travail dans un environnement intellectuel plus large, qui tienne compte des relations entre leurs idées spécifiques de recherche et les grands problèmes de la science, de la politique scientifique ou de la société [6]. Un récent éditorial de *Nature*, qui défendait la science contre une certaine anti-science, en appelait à « une description de sa signification pour le monde...pour *reconnaître sa propre identité* » [7] (non souligné dans le texte).

Le centre de la politique scientifique

Malheureusement, les politiques scientifiques montrent peu d'intérêt pour ce genre de préoccupation. En conclusion de l'article cité ci-dessus, l'auteur considère que le but de la science est « d'améliorer les connaissances », définition qui rencontre peu d'échos auprès des décideurs : ils parlent plutôt en termes de progrès matériel, de protection sociale, d'applications et de techniques. Il n'est pas jusqu'à l'objectif de la collaboration internationale qui prend un tout autre sens dans leur bouche. L'Europe des sciences cherche à unir ses efforts et donc à avancer plus vite sur un même chemin ; et les responsables scientifiques, aux États-Unis comme en Europe, ont plus le souci de ne pas se laisser distancer et de rester dans le peloton de tête, que d'enrichir la communauté scientifique grâce à des perspectives nouvelles. On peut ainsi craindre que les pays de l'Union européenne perdent de leurs atouts scientifiques si une telle homogénéisation est poussée trop loin [8].

Pour certains analystes, le scientifique serait, en général, d'une nature conservatrice, foncièrement peu encline à la marginalité, à la divergence ou aux changements radicaux. Le manque de personnel peut être aussi une source de concentration dans la mesure où des effectifs scientifiques convergent vers le centre [9]. Si l'on ajoute à cela le poids des grands projets, il n'est pas étonnant que les jeunes scientifiques américains se désolent de devoir apprendre à tourner le système avant même d'avoir acquis les règles de l'art [10]. Les Français, eux, sont stimulés par le dynamisme de la science du centre, et certains, une fois rentrés, vont essayer de le recréer et de jouer le rôle de vecteurs de diffusion d'une certaine forme de science.

Pourtant, une étude plus attentive de la dynamique centre-périphérie de la mobilité fait apparaître sa complexité et sa diversité. On peut, en effet, y voir un outil au service de la carrière du scientifique, soit qu'il renforce son crédit au centre, de façon conservatrice, soit au contraire qu'il favorise l'émergence d'idées marginales et de forces centrifuges. La simple différence, ne serait-ce que de l'organisation centrale, entre deux pôles scientifiques importants comme la France et les États-Unis peut aussi réduire les forces conservatrices que le scientifique rencontre dans son environnement initial. La mobilité est donc un moyen d'avancement d'une carrière, qu'elle soit « conservatrice » ou non. En Europe où elle est plus développée qu'aux États-Unis, elle devient à la fois outil et objectif de politique scientifique, en particulier au niveau de l'Union européenne, ce qui n'est pas encore le cas aux États-Unis où l'accueil d'une main-d'oeuvre scientifique étrangère reste un phénomène passif.

La complexité des centres « perçus » et des périphéries

Même si un doute peut planer sur l'existence d'un centre objectif, la mobilité garde ses d'attraits auprès des scientifiques français, grâce à la réputation bien connue de l'Amérique comme centre scientifique. Bien souvent, il y a convergence entre la perception des centres et la présence de financements. Mais que dire des riches universités texanes - pétrole oblige - qui « achètent » à Cambridge des scientifiques de renom ? Si ce n'est qu'elles confirment la notion de « centre perçu », et qu'elles établissent des centres rivaux, sur des sites périphériques. On peut aussi citer l'attraction mutuelle entre les sociologues français et les universités américaines les plus importantes. Pour ces intellectuels de renom, l'Amérique est un centre qui se caractérise par des salaires élevés et par un style de vie fort apprécié. Mais il ne faut pas oublier qu'ils emportent dans leurs bagages la longue tradition culturelle des centres européens. Alors, où se situe la périphérie ?

Il convient d'apporter quelques nuances aux raisons qui poussent les Français à acquérir une formation en Amérique. Nous avons découvert que s'ils sortaient tous de très bons établissements, les candidats au Ph.D. et les chercheurs post-doctoraux n'étaient pas tous diplômés des « Grandes écoles ». Les entretiens que nous avons conduits ont montré clairement que beaucoup viennent aux États-Unis pour acquérir un atout supplémentaire dans leur carrière. Or un centre définit ses propres standards de formation, et il ne sera donc pas un « centre absolu » s'il n'attire pas les meilleurs candidats. En fait, il semble que les jeunes scientifiques français de valeur viennent aux États-Unis pour y bénéficier d'un certain type de formation, alliant recherche et enseignement, qui y est beaucoup plus largement pratiqué qu'en Europe. S'ils sont impressionnés par le dynamisme de l'environnement universitaire, les Français le sont moins par le niveau scientifique de leurs homologues américains, en particulier en mathématiques.

Une image plus nuancée des jeunes scientifiques « périphériques » cherchant une formation de « centre » se dessine lorsqu'on prête l'oreille aux commentaires des jeunes scientifiques américains sur la formation qu'ils trouvent en France. La plupart d'entre eux ont été frappés par le niveau élevé des étudiants, et le point fort de leur expérience est en général la qualité de l'équipe d'accueil. Interrogés sur la valeur de l'établissement qui les a reçus, ils ont reconnu que les meilleurs d'entre eux étaient à placer au même niveau que les dix meilleurs établissements américains. Réciproquement, les jeunes scientifiques français caractérisent l'Amérique comme un centre percu, qui a toutes chances d'enrichir un curriculum vitae ; mais aussi par le style de la recherche qui s'y pratique, menée tambour battant, compétitive et motivée par l'argent : l'Amérique est sans aucun doute le champion de cette façon de faire, qui fascine les jeunes Européens, qu'ils décident ou non de l'importer chez eux.

Il faut encore nuancer la notion de centre scientifique en fonction de la discipline. Il n'est nul besoin, pour les Français, de rechercher à l'étranger des centres forts en mathématiques ou en anthropologie, alors qu'il n'en est pas de même en sciences de la terre ou en chimie. Nous aimerions, en sens inverse, citer cette anecdote intéressante : nous avons rencontré un historien américain qui, vingt ans auparavant et par une série de coïncidences heureuses, s'était retrouvé au coeur du bastion français de sa spécialité, situation des plus improbable pour un « périphérique » tel que lui. Ce fut là la chance de sa carrière, ses travaux ayant bénéficié de plus de dix ans d'une recherche impossible à mener dans son propre pays [11].

Certains scientifiques, américains ou français, traversent l'Atlantique pour des raisons dues uniquement à leur spécialité, en quête d'une technique ou d'une méthode de recherche. Pour eux, le centre est donc ailleurs. On peut voir, du moins en partie, dans la querelle franco-amé-

ricaine sur la découverte du virus du Sida, le recentrage d'un domaine dont les pionniers étaient français. De même, des approches ou des théories alternatives peuvent se concentrer dans un environnement donné ; ainsi, en sciences économiques, la France est devenue en quelque sorte un centre d'approches périphériques. Dans des disciplines telles que la linguistique, la physique ou l'épistémologie, cette raison a joué pour certains des scientifiques américains qui se sont installés définitivement en France.

Il ne faut pas oublier que les pays de poids scientifiques différents ne s'ordonnent pas de façon concentrique. Ainsi, la mobilité entre les pays en développement et l'Europe n'a pas la même configuration que celle entre l'Europe et le centre des centres, l'Amérique. Les scientifiques africains viennent en France pour y trouver un environnement d'un niveau manifestement supérieur au leur, ce qui n'est pas le cas des chercheurs post-doctoraux français qui se rendent aux États-Unis. Les scientifiques algériens trouvent en France un centre en matière de science, tandis que les français vont en Amérique pour équipement, communication et dynamisme, heureux compléments de ce qu'ils possèdent chez eux. Entre l'Algérie et la France la mobilité scientifique s'effectue à sens unique, alors qu'elle fonctionne dans les deux sens entre la France et les États-Unis, entre centres spécifiques ou micro-centres, même si les échanges ne sont pas symétriques en volume. Le faible flux de scientifiques américains vers les centres forts français n'est toutefois pas dû à la rareté de ces derniers. La dynamique des courants centre-périphérie se complique si l'on prend en compte un pays comme l'Inde, nation qui connaît un développement économique partiel, mais qui s'est dotée d'installations scientifiques de premier ordre : ses futurs chefs de file scientifiques continuent pourtant de venir dans les pays occidentaux pour y gagner leurs galons [12].

La mobilité entre centres secondaires apporte autant de bénéfices qu'un séjour aux États-Unis. Un centre peut aussi devenir une sorte de poids mort ; or une communauté scientifique internationale ne reste vivante que si elle crée une force d'attraction entre centres secondaires. Avec le bond en avant qu'a fait la science européenne, l'attrait de l'Amérique a diminué, rendant la mobilité plus intra-européenne. En d'autres termes, l'attirance pour les États-Unis a cédé quelque peu le pas devant des considérations de distance et de coûts. Il existe donc de nombreux mouvements entre les centres, qui s'opèrent dans un contexte centre-périphérie classique, et au niveau national, ce que corroborent les études classiques sur la mobilité à partir de statistiques nationales. Il pourrait être intéressant d'approfondir notre recherche en étudiant la relation entre pluralité scientifique et distance. Cette dernière joue certainement un rôle plus grand en Europe qu'en Amérique. L'étude des vecteurs de la mobilité permettrait d'identifier des sous-régions de mobilité préférentielle, y compris par delà les frontières. Une cartographie du phénomène ferait certainement apparaître deux types de mobilité, tous deux bénéfiques d'ailleurs : l'une qui renforce les liens et points communs au sein d'une région, d'un centre ou d'un pôle ; l'autre qui encourage les contacts et les échanges inter-régionaux et favorise la diversité. En Europe, encourager ces mobilités irait bien dans le sens de la volonté des régions d'affirmer leur propre identité. Mais cette idée même constitue un véritable cauchemar pour les décideurs, qui craignent l'émergence d'un phénomène de fractionnement et de conflits, oubliant qu'en science, du moins, la diversité est source d'enrichissement et non d'inefficacité.

Pour de nombreux scientifiques américains et français, les considérations de niveau scientifique seront toujours au coeur de la mobilité, même lorsqu'une expérience inter-culturelle reste un critère de décision. On veut en prendre pour exemple le fait que toute discussion sur leur expérience reste centrée sur son contenu scientifique. Et c'est là que la *perception* de centre ou de qualité prend toute sa valeur, c'est là que se situe l'une des principales contributions de la mobilité des scientifiques : les idées et les méthodes nouvelles que les chercheurs rapportent de leurs séjours modifient, à leur retour, les comportements et les perceptions dans leurs propres laboratoires. Les périphéries ne sont pas toujours des culs-de-sac, et les scientifiques mobiles sont autant d'explorateurs qui contribuent à changer la physionomie du monde de plus en plus complexe de la recherche.

Bien que les pays en développement se situent en dehors de notre étude, il pourrait être intéressant d'y inclure, dans un cadre plus large de la mobilité des scientifiques, quelques considérations sur la périphérie scientifique qu'ils constituent. Il convient d'abord de rappeler que l'« aimant » scientifique européen, pris comme modèle, n'est en fait qu'une résurgence du rôle culturel et intellectuel que l'Europe a joué pendant des siècles. En voulant transplanter massivement la technologie dans les régions en développement [13], on ignore que pour en assurer le succès il faut disposer d'un substrat culturel particulier [14]. De toute façon, l'avance scientifique occidentale a pour origine aussi bien la curiosité intellectuelle qu'une vraie stratégie d'investissement. Par ailleurs, les centres et les périphéries ont tous un rôle à jouer. S'il n'est pas nécessaire que chaque nation essaye de devenir un centre scientifique indépendant, elle se doit, par contre, de développer son propre potentiel culturel, intellectuel et scientifique. Il y a de fortes chances pour que les programmes de R & D des régions en voie de développement relèvent de moyens différents pour atteindre leurs propres objectifs. C'est pourquoi, s'aligner sur un modèle central peut conduire à mettre en oeuvre une politique scientifique inadaptée à de telles régions périphériques. Enfin, si nous replaçons mobilité et centralisme dans le cadre d'un espace ouvert, il devient évident que la périphérie ne doit pas se résoudre dans un modèle centraliste. Nous y percevons, au contraire, toute une variété de contributions locales, plus ou moins importantes, à une mosaïque de sciences et de méthodes.

Centre de publication et langue employée au centre

La prédominance d'un centre se mesure aux publications considérées comme essentielles à une carrière scientifique qui sont ainsi placées sous le contrôle des courants dominants dans cette sphère, à un moment donné. Dans de nombreuses disciplines, ces journaux sont publiés aux États-Unis. Ceux qui effectuent la sélection des articles peuvent représenter un collège, plus ou moins large, plus ou moins international, mais pas toujours très « invisible ». Les constructivistes, notamment, ont montré que la publication est, en terme de productivité, l'acte le plus important du scientifique. Même si l'on ne les suit pas entièrement, il faut reconnaître qu'ils ont su mettre en lumière le fait que la publication est l'aboutissement ultime de la plupart des démarches scientifiques [15]. De plus, les travaux les meilleurs sont destinés à être diffusés dans le monde entier, c'est-à-dire à être publiés dans des revues de renommée internationale.

Si les scientifiques ne citent pas ouvertement la publication comme une des raisons de leur mobilité, il existe néanmoins un lien entre mobilité et accès à des revues du plus haut niveau. Ce n'est, en effet, que par des contacts et des collaborations, plus qu'à l'occasion de congrès et de séminaires, que l'on peut faire reconnaître son travail par des collèges internationaux et en particulier anglo-américains. La mobilité peut réduire à la fois les distances et les barrières linguistiques entre les scientifiques et les meilleurs « points de vente » de leurs travaux les plus importants. Si la mobilité était plus fréquente et plus uniformément répartie, la qualité des travaux scientifiques serait mieux reconnue, où qu'ils se situent, et les publications seraient mieux partagées et d'accès plus facile. Mais, comme nous l'avons montré, la mobilité est peu pratiquée par certains, et en particulier par les Américains. En conséquence, la dominance par le centre de l'accès au « marché » est perpétuée par l'ignorance de la qualité de la science internationale dont ce centre fait preuve. Seule la mobilité à partir du centre a quelque chance de changer la situation, mais les scientifiques du centre n'en ressentent manifestement pas le désir pour des raisons d'accès aux publications.

L'accumulation des forces centripètes engendrées ou à tout le moins aggravées par l'accès à la littérature est quelquefois masquée par les études bibliométriques de la collaboration internationale et par l'apparente internationalisation de la science ainsi révélées. Elles s'appuient, en général, sur les données du SCI, le Science Citation Index, mais elles passent souvent sous silence le nom des publications et la langue dans laquelle est écrite la majorité des articles rédigés en collaboration, de même que la sous-représentation des Américains, scientifiques du centre, dans l'ensemble des publications internationales publiées en collaboration. On en voit l'illustration dans les indices de citation [16], les scientifiques du centre lisant les journaux du centre et ne pouvant donc citer que ce qu'ils lisent. Les articles scientifiques écrits par des Français sont cités, sur une période de plus de cinq ans, 40 pour cent plus fréquemment que la moyenne des articles français, lorsqu'ils sont publiés dans des publications américaines, et 80 pour cent de plus que ceux publiés en dehors des États-Unis. Au total, les auteurs non-américains publiés dans les journaux américains sont cités deux fois plus que ceux publiés dans des journaux non-américains. Il pourrait d'ailleurs être intéressant de se pencher sur les nationalités du citateur et du cité, et de savoir si les Américains citent facilement leurs confrères étrangers.

Un effort de la part des scientifiques français pour copublier avec des Américains leur permettrait d'avoir accès aux revues américaines, pour contrebalancer l'effet du centre. Pour l'année 1988, que nous avons choisie comme référence, les publications franco-américaines constituaient un quart de l'ensemble des publications franco-étrangères, et près de 40 pour cent de celles publiées dans la presse scientifique américaine. En définitive, un article franco-américain a 3,4 fois plus de chance d'être publié dans une revue américaine qu'un article français, et 3,2 fois plus de chance qu'un article franco-étranger n'incluant pas un scientifique américain.

L'effet de domination dû à la réputation du centre se perçoit dans le fait que les articles scientifiques américains publiés à l'étranger sont cités deux fois plus souvent que la moyenne de tous les articles publiés en dehors des États-Unis. A titre de comparaison, le taux de citation des articles américains dans les revues américaines n'était que légèrement supérieur à celui des articles non-américains. Par conséquent, un article américain perd très peu de son impact absolu en étant publié à l'étranger, et il gagne beaucoup en impact relatif, puisque l'indice relatif de citation, c'est-à-dire le taux de citation divisé par le taux de citation moyen mondial, sur cinq ans, passe de 1,01 à 1,60. Les copublications internationales par des Américains dans les revues américaines ne représentent que 12 pour cent de l'ensemble des copublications dont aucun des auteurs n'est américain : ceci manifeste la puissance d'attraction de la presse scientifique américaine. Même pour une nation aussi scientifiquement avancée que la France, cette force est telle qu'un tiers des publications franco-étrangères sans coauteur américain paraît dans une revue américaine.

Mais si l'Amérique est la capitale mondiale de la science, elle semble être coupée de ses « provinces ». Si l'on se penche sur la nationalité des laboratoires, on voit que, selon les journaux américains, la production scientifique américaine représente 73 pour cent de la production totale des nations du G-7, mais 21 pour cent seulement des résultats paraissent dans des publications non-américaines. Une comparaison effectuée entre 1983 et 1988 indique pourtant une progression des publications étrangères dans les journaux américains : celles du « G6 » y passent de 18 à 22 pour cent ; par contre, aucune augmentation n'est en vue pour les publications américaines à l'étranger. Quant aux copublications, elles traduisent bien l'image d'un centre en partie isolé, puisque seuls 3,4 pour cent des publications américaines dans des journaux américains impliquent une collaboration internationale. A titre de comparaison, une participation internationale est présente dans 10 pour cent de la production scientifique française. Et même lorsque les scientifiques américains publient à l'étranger, une collaboration internationale n'est en jeu que pour 8 % de ces publications. Un centre isolé ne peut certes jouer qu'un rôle secondaire en matière de coopération internationale : les publications américano-étrangères ne repré-

sentent que 7,7 pour cent de la totalité des copublications américaines, contre 26 pour cent en France. Par contre, si l'on fait abstraction de la collaboration franco-américaine, conséquence de l'attraction que les Français ressentent pour le centre, on s'aperçoit que ceux-ci choisissent des collaborateurs étrangers, donc non-américains, 2,3 fois plus souvent que ne le font leurs collègues américains.

Le paysage change beaucoup d'une discipline à l'autre, mais c'est là une analyse qui sort de notre propos. Il peut néanmoins être intéressant de noter le point suivant. Comparons l'impact relatif sur cinq ans, tel que défini plus haut, des articles français publiés dans les revues américaines, et celui de la production française en dehors des États-Unis : sur les neuf catégories de disciplines prises en compte par le SCI, l'impact de quatre d'entre elles augmente de façon significative lorsque la publication est faite à l'extérieur des États-Unis : il passe de 0,90 à 1,40 pour la chimie, de 0,95 à 1,29 pour la physique, de 1,00 à 1,20 pour les sciences de la terre et de l'espace et de 0,88 à 1,04 pour la recherche biomédicale. Par contre, deux d'entre elles ont un impact relatif en hausse lorsque la publication est faite dans des journaux américains : de 0,90 à 1,40 pour la biologie, et de 0,88 à 1,14 pour la médecine clinique. Si l'on garde à l'esprit combien le nombre de citations diffère selon que les articles sont ou non publiés aux États-Unis, on peut voir dans ces grandes différences par discipline une mesure de la façon dont certaines disciplines scientifiques françaises surmontent la perte d'impact qu'entraîne une publication faite en dehors des États-Unis.

Le risque de partialité du centre dans le choix des publications, en fonction du pays d'origine, est bien sûr un souci pour les scientifiques. Les études faites à ce sujet ont tendance à ignorer le processus de sélection et à ne considérer que ce qui a été publié. Stephen Cole s'est intéressé de près à un exemple de jugement par les pairs, celui des décisions budgétaires de la NSF. Il ne touche directement ni l'international ni les publications. Sa conclusion vaut cependant d'être citée : la chance y entre pour beaucoup [17]. Elle laisse à penser, par analogie, que le mérite n'est pas le seul facteur en jeu dans la procédure de sélection d'un journal. L'ancien directeur de l'Inserm (Institut national de la recherche médicale),qui fut professeur d'une école renommée de médecine aux États-Unis, suggérait qu'il y aurait peut-être des « parcours plus courts et des parcours plus longs » lors des procédures d'évaluation des principaux journaux [18]. Des scientifiques non-anglophones, très actifs dans leurs collèges internationaux, signalent de leur côté l'élimination d'articles pour des raisons mineures de stylistique anglaise.

Parce qu'elle fait prendre conscience du caractère universel de la science, la mobilité peut être un moyen d'améliorer les procédures de sélection des publications internationales de haut niveau. Il est indéniable qu'un centre a sa propre langue, officielle. Mais beaucoup diront que l'anglais pas toujours très orthodoxe, utilisé à travers le monde par les scientifiques, est devenu le « jargon » de la profession de chercheur. Et ce « jargon » est la langue véhiculaire qui permet à deux scientifiques périphériques, de langues différentes, de communiquer. L'anglais passe pour être la langue la mieux adaptée aux sciences expérimentales. De toute manière, il convient de distinguer la fonction véhiculaire de ce « jargon » du concept de centre anglophone [19]. Il n'est pas non plus irréaliste d'encourager les publications faites dans d'autres langues, ou même polyglottes [20]. La langue employée est d'autant plus importante qu'une publication n'est pas seulement la simple communication de résultats, comme le laissent croire la plupart des travaux bibliométriques. Elle constitue aussi, pour une grande part, le « produit » scientifique lui-même. Une littérature partisane met trop en lumière la science du centre, et laisse dans l'ombre celle des centres secondaires ou de la périphérie, ajoutant ainsi à l'effet de concentration, puisque la notion de centre repose dans une certaine mesure sur la manière dont il est perçu. L'acte que constitue l'utilisation du langage ne peut pas être qu'un simple enregistrement car il est part entière du processus de la découverte. La polyphonie devient donc un facteur inhérent au développement scientifique.

Apparence et réalité

Entre le scientifique professionnel, souvent recruté pour répondre à des impératifs économiques, d'ordre national en général, et le chercheur indépendant, la science se cherche une identité. Les échanges internationaux pourraient aider à la définir, en mettant une sourdine à l'aspect « alimentaire » de la science et en remettant donc en faveur un type de recherche plus traditionnel. Pour le constructiviste, qui est persuadé que le savoir scientifique se fabrique entièrement, cela n'a sans doute que peu d'importance : ce n'est pour lui qu'une simple différence de méthodes de production. Mais pour ceux qui sont persuadés que sous l'habit de scientifique préoccupé par sa carrière se cache parfois un découvreur, les échanges, les déplacements, les migrations et la connaissance de la qualité scientifique de l'étranger peuvent apporter beaucoup. Cette contribution apparaît en partie pour qui dessine les contours de la mobilité, parce que dans leur complexité et leur individualité les scientifiques échappent à l'analyse simpliste du centre fort et de la périphérie faible, et des vecteurs évidents qui les relient.

Il n'en reste pas moins que certains mécanismes entretiennent une prépondérance du centre sans aucune mesure avec la qualité scientifique et à contre-courant du développement international des sciences. On l'a bien vu en abordant le problème des publications. Il est bien difficile de savoir si la mobilité des scientifiques, instrument d'indépendance et d'accès pour tous à une science de haut niveau, pourra survivre à la fois aux politiques orientées par l'économie et aux préjugés injustifiés en faveur du centre. Les objectifs traditionnels des politiques se confondent avec un rêve de simplicité, voire d'homogénéité complète entre les centres, et les préjugés en leur faveur entraînent une mobilité à sens unique. De cette situation pourrait résulter un fossé creusé entre des centres « apparents » et des centres « réels ». Il existe déjà dans une certaine mesure, mais il est masqué non seulement par la force apparente du centre mais aussi par l'habitude prise de considérer l'anglais comme langue véhiculaire.

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[1] Brooks, H., « Lessons of History : Successive Challenges to Science Policy », in S.E. Cozzens, P. Healy, J. Ziman, Ed. *The Research System in Transition* (Dordrecht/Boston/London : Kluwer Academic Publishers, 1989) pp. 17-20.

[2] Le bulletin de politique scientifique de la Maison-Blanche, A Vision of Change, évoque une « recherche stratégique » pour augmenter la compétitivité américaine, comme le cite un éditorial dans « Hearing for Basic science », *Nature*, 367, (3 février 1994), p.396.

[3] Park, R.E., « Human Migration and the Marginal Man », *American Journal of Sociology,* 33, (6), (1928), pp. 881-893.

[4] Ziman, J., *Puzzles, problems and enigmas,* (Cambridge : Cambridge University Press, 1981), chpt. 32, p. 259 ff.

[5] Un nouvel outil d'enquête de politique scientifique utilisé par le Centre national de la recherche scientifique français (le plus important employeur de scientifiques payés par l'Etat) a soulevé une tempête de critiques parce qu'il avait été calqué, sans modifications, sur un modèle japonais. Bien que les questions aient été essentiellement de nature scientifique, leur contenu culturel avait provoqué l'inquiétude des scientifiques. Voir « Une enquête de prospective technologique suscite une polémique parmi les chercheurs français, » *Le Monde*, (11 mars 1994), p. 12.

[6] Le « cadre général » peut effrayer. Certains scientifiques sont ouvertement ennemis de la métaphysique, obstacle à la science. On peut sentir une certaine nervosité lors de discussions sur la quantification de la gravité, ou la réduction de la conscience à un problème solvable.

[7] Maddox, J., « Defending Science Against Anti-Science », *Nature*, 368, (17 mars 1994), pp.185.

[8] Gispert, R., « La coopération scientifique internationale », *La pensée*, 264, (1988), pp. 31-41.

[9] Andler, M., « American Mathematics and the Rest of the World », *Notices of the American Mathematical Society*, 37, (7), (1990), pp. 853-855, pour un exemple tiré des mathématiques.

[10] Hackett, E.J., « Science as a Vocation in the 1990's, the changing Organizational Culture of Academic Science », *Journal of Higher Education*, 61, (3), (1990), pp. 241-279, p. 259.

[11] On peut trouver une illustration frappante de cette contribution périphérique (histoire) dans l'invitation qui a été faite récemment à l'historien américain, Robert Paxton, auteur de la meilleure histoire écrite sur Vichy, d'être conférencier du prestigieux symposium M. Bloch lors de la commémoration du cinquantenaire de l'exécution de ce grand historien et résistant.

[12] Bien qu'inquiète de cette évasion de cerveaux, l'Inde est aussi un centre d'attraction régional avec une longue tradition d'excellence de son enseignement. D'après les statistiques de l'Unesco, l'Inde figure parmi les vingt premiers pays qui accueillent dans leurs universités des étudiants étrangers, avec en tête la Suède ; la plupart d'entre eux proviennent de l'Asie du Sud-Est et de l'Afrique de l'Est. Johnson in Johnson, J.M., NSF, National Science Foundation (USA), Human Resources for Science and Technology : The Asian Region. (1993) indique que des 4937 doctorats délivrés en sciences naturelles dans les pays asiatiques choisis pour l'étude (y compris le Japon et la Corée du Sud) 3500 l'ont été par des universités indiennes.

[13] Navaz Sharif, M., « Problems, Issues and Strategies for S & T Policy Analysis », *Science and Public Policy,* 15, (4), pp.195-216. Un exemple de théorie sur la transplantation de la science et de la technologie.

[14] Pour voir le peu de compréhension que ce domaine rencontre, lire : Dedijer, S., « Why Did Daedalus Leave ? », *Science*, 133, (30 juin 1961), pp. 2047-2052. L'auteur y demande une « écologie de la recherche » ou une étude de l'environnement social local comme sujet d'un travail scientifique. p. 2052.

[15] Knorr-Cetina, K.D., *The Manufacture of Knowledge, an Essay on Constructivism and Contextual Nature of Science*, (Oxford, New-York : Pergamon Press, 1981). chpt.5, pp. 94-96.

[16] Nos calculs proviennent de données de mesure bibliographique puisées dans la base de données de l'OST (Observatoire des Sciences et des Techniques, Paris). Cette base est un traitment du Science Citation Index qui est lui-même le seul outil de mesure de ce genre. Le fait qu'il soit américain ajoute un préjugé accentuant l'effet de centre.

[17] Réédité dans Cole, S., *Making Science: Between Nature and Society*, (Cambridge, Ma. and London : Harvard University Press, 1992), pp. 82-101.

[18] Un entretien avec Philippe Lazar : Nouchy, F., Un entretien avec Philippe Lazar : « La loi Toubon est un combat d'arrière-garde », *Le Monde*, (21 juin 1994), p. 2.

[19] La langue officielle n'est pas un indicateur fiable des activités d'un centre ; la nomenclature latine n'indique en aucune façon que Rome est le centre de la recherche botanique !

[20] Lazar dans F. Nouchy, *op. cit*. : il y donne un exemple très réussi de littérature polyglotte : *Médecine-Sciences*, revue éditée en France et très lue.

The Conditions and Dynamics of Migrations: Case Studies

Part 3

Patterns of Collaboration of Scientists at the National University of Mexico (UNAM)

Jane M. Russell

Margarita Almada de Ascencio

Introduction

Collaboration in science has been shown to be an effective mechanism to advance research, as well as a means to increase productivity and visibility (Pao, 1992). The fact that international scientific collaboration has become a political objective as shown by the establishment of government initiatives for the enhancement of this activity, suggests that collaboration which transcends national boundaries is seen as a particularly good thing (Luukkonen, Persson and Sivertsen, 1992).

In the developing country situation, establishing contact with colleagues from countries with a high scientific research profile is believed to compensate to some extent for the isolation and shortcomings of the emerging scientific communities in these regions. The integration of scientists from countries on the periphery and especially those from the developing world, into the global scientific community is considered an important requisite for improving national research performance. Levels of international coauthorships are inversely related to the scientific size of a country (as expressed through the number of publications in the mainstream scientific literature). Developing and small industrialised countries with only small shares of international publication counts, make more significant contributions to the volume of internationally coauthored papers (Luukkonen et al., 1992)

The degree of international contacts and its effect on research performance of scientists in a small industrialised country has shown a relatively strong correlation with respect to contact frequency, conference participation and publishing in all fields of learning (Kyvik and Larsen, 1994). However, Carlson and Martin-Rovet (1995) suggest that only through contacts and collaboration, more than through conferences and seminars, can recognition be gained for work internationally. Mobility can reduce barriers of both distance and language between scientists and the best outlets for their most important publications. They see mobility too as a career device, as a way round some of the constraints faced by scientists in different environments.

In the present paper we look at the relative importance in terms of research performance of the links established with national and international colleagues for scientists in a developing country. We used as subjects for our analysis 15 of the most productive researchers working in five different scientific fields at the National University of Mexico (UNAM), institution responsible for approximately 42 % of Mexican research papers published in the international scientific literature. A case study is presented of the collaboration and citation patterns of one of the physicists (Physicist 1) who showed a particularly high level of international mobility. This analysis forms part of a broader research project on the relationship between collaboration and research performance of Mexican scientists.

Methodology

Patterns of collaboration

Three UNAM scientists from each of the five following research areas were selected for an in-depth study of their activities : Biomedical Research, Chemistry, Physics, Astronomy and Astrophysics, and Geosciences. Areas were selected on the basis of the following criteria : the need for representation of a wide range of scientific disciplines, and the desire to give special importance to those subject areas where UNAM scientific research makes an important contribution at international level.

The criteria for selection of the individual scientists were based on their 1985-1989 publication counts in the Science Citation Index (SCI) CD-ROMs. Scientists chosen had published at least five documents as first author, and a total of between 10 and 35 documents as first or coauthors. This strategy was chosen after a preliminary analysis of the publication levels of UNAM scientists in the SCI database, and the need to have a sample of 15 scientists with comparable levels of publication. In addition, researchers had to be affiliated to the UNAM from 1980 to 1994, and be willing to cooperate with the research project. When two authors commonly published together, only one was chosen in order to avoid analysis of basically the same publication set.

The 15 scientists chosen were asked to provide their CVs updated to the end of 1994. Analysis of papers was based on the publications reported in the individual CVs and corroborated with records in the SCI files. Details of institutional affiliations were taken from the SCI records or checked with the original papers. Analysis of coauthorships was determined for four types of publications only : articles, notes, reviews and letters (referred to as papers in this study), in accordance with recommendations made by Schubert, Glanzel and Braun [1989]. These authors consider that these four types of documents are the only ones which receive a significant number of citations in subsequent publications, and are therefore relevant in impact orientated analyses.

Distinctions were made with regard to the different levels of coauthorships in accordance with the following classification : 1) UNAM, coauthorship with member(s) of his/her own UNAM faculty, research centre or institute, or with member(s) of other UNAM faculties, centres, or institutes, 2) national, where coauthorship is with colleagues from other national institutes, and 3) international, in the case of coauthorships with foreign institutions. The frequency of institutional collaborations at different levels was calculated for each paper according to the number of times the UNAM scientist appeared as coauthor with author(s) from different institutes, regardless of the number of coauthors involved. For instance, a paper involving six coauthors from two foreign institutes, was assigned two foreign institutional collaborations. Papers where the UNAM scientist was the sole author were assigned the institutional level corresponding to the affiliation reported in the paper.

Relationship between coauthorship and citation patterns

In addition to the coauthor analysis mentioned above, citation analysis was carried out on the 1985-1989 papers of Physicist 1 using the SCI CD-ROMs. The 1985-1993 citations to these papers were downloaded onto diskettes and converted into MICRO-ISIS version 2.32 database format. Additional fields were coded corresponding to the countries of the citing institutions. Records were manipulated using FOXPRO version 2.0 software to relate data on citing articles with that of the cited articles (authors, institutions, countries, and years).

Results

Patterns of collaboration of the 15 scientists.

The 15 scientists produced a total of 797 papers from 1980-1994, with individual production ranging from 34 to 68 (from 2.3 to 4.5 papers per year). Of these, 232 papers (29.1 %) were published in collaboration with authors from overseas (Figure 1). The physicists showed the highest level of international coauthorship (41.1 %), followed by the astronomers (33.9 %), and the geoscientists (30.6 %). The biochemical researchers and the chemists showed lower levels (25.4 % and 17.0 %, respectively).

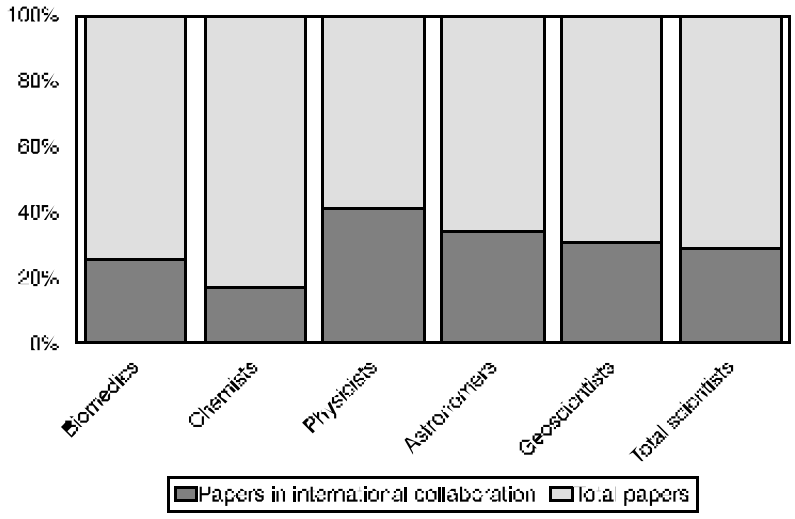


Figure 1. 1980-1994 papers in international collaboration of the 15 scientists in different disciplines

While the number of papers written either as the sole author or in collaboration with national colleagues fell from 1988 onwards, the number of papers coauthored with colleagues from foreign institutions showed a definite upward trend (Figure 2). In 1980 25.6 % of papers were international, a percentage which reached 35.8 % in 1994. Figures peaked in 1986, and again in 1993, year in which the number of international papers surpassed those published alone or with national counterparts.

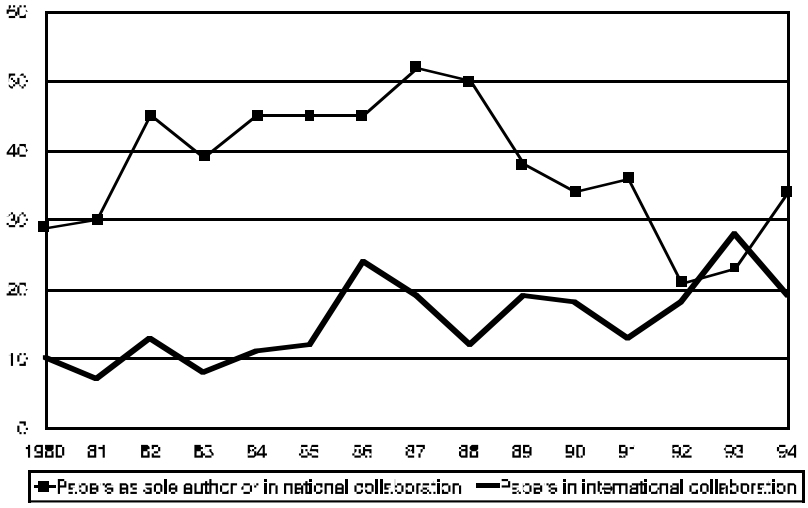


Figure 2. Annual production of papers in national and international institutional collaboration of the 15 scientists

Institutional coauthorships at UNAM level followed closely the annual production of papers indicating the important role of colleagues from the same institution in the research task (Figure 3). Collaboration with foreign institutes took on increasing importance during the 15 years studied. The peak in production seen during the mid 80's was associated with a peak in the number of international institutional collaborations. However, while the production of papers began to drop thereafter (picking up again from 1992), coauthorships with institutions abroad continued to rise. Collaboration with other national institutes was less significant and show no well-defined pattern.

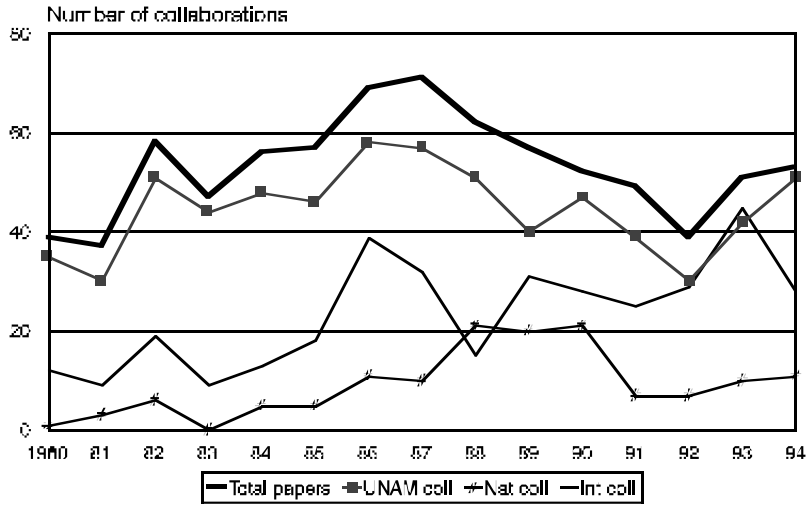
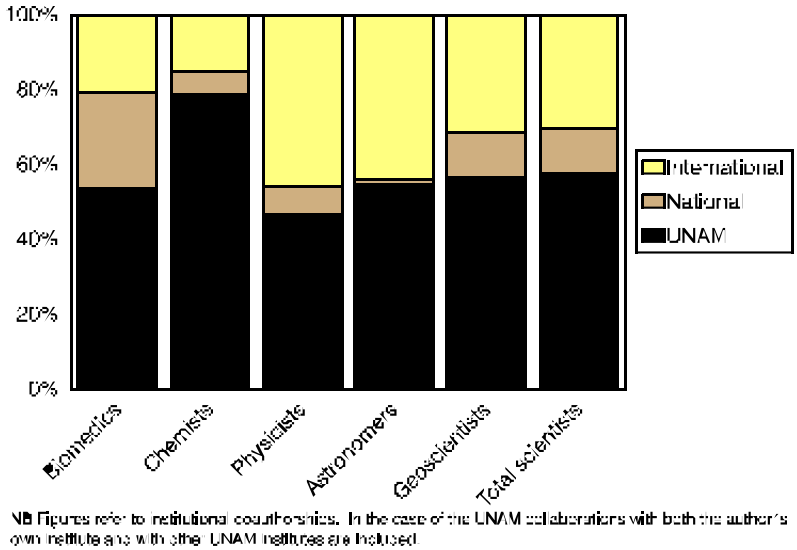


Figure 3. Different levels of institutional collaboration and annual production of papers of the 15 scientists

However, collaborations at different institutional levels varied between disciplines. In general, collaboration within the UNAM represented 57.7 % of the total number of collaborations, with other national institutions, 11.9 %, and with institutions abroad, 30.4 % (Figure 4). However, approximately one quarter of the institutional collaborations of the biomedical researchers were with other national institutions, a figure noticeably higher than in other disciplinary groups. Almost 80 % of the chemists' institutional collaborations were with colleagues from their own institution while the physicists and the astronomers showed high collaboration rates with institutions abroad (approx. 45 % in both cases).



NB Figures refer to institutional coauthorships. In the case of the UNAM collaborations with both the author's own institute and with other UNAM institutes are included.

Figure 4. 1980-1994 institutional collaborations of the 15 scientists in different disciplines

Taking the biomedical researchers as an example of a group with a high collaboration profile at national level, Figure 5 shows the annual tendency of all levels of their institutional collaborations from 1980 to 1994. Coauthorship with other national institutions showed a sharp rise from 1980 to 1989, after which period it showed a definite decline. However, both collaboration with colleagues from the UNAM and that with other national counterparts followed fairly closely the production of papers. The exception was from 1987 to 1989 when collaboration with the UNAM dropped with a simultaneous rise in coauthorships with other national institutes. International collaborations also showed a notable increase up to 1990 after when they declined.

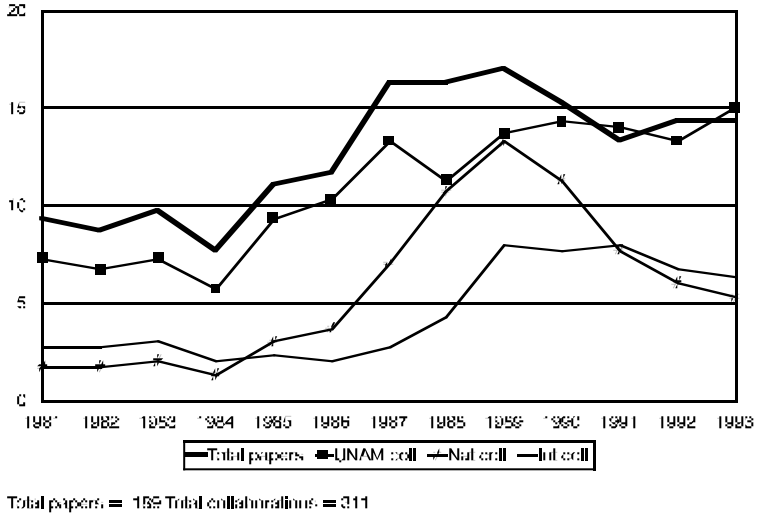


Figure 5. Different levels of institutional collaboration and annual production of papers (3yr moving averages) of the biomedical researchers

In the case of the institutional coauthorships of the physicists and astronomers which show an important international component, collaboration with colleagues from the UNAM showed a decline from 1983 through to 1992, while international collaboration was on the increase (Figure 6). From 1986 onwards the number of international institutional coauthorships followed closely the levels of production of papers, suggesting a direct relationship between these two variables. The peaks in the production of papers found in 1987, 1989, 1991, and 1993 coincided with peaks in the number of coauthorships at international level. Increases in the number of UNAM collaborations also followed this pattern suggesting an association between this parameter and international coauthorship.

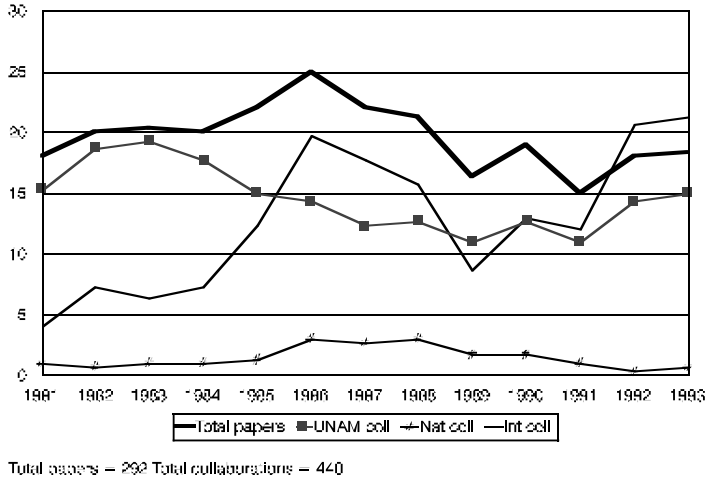


Figure 6. Different levels of institutional collaboration and annual production of papers (3yr moving averages) of the physicists and the astronomers

The addresses reported by the different groups of UNAM scientists in papers coauthored with foreign institutions are analysed in Figure 7. In 76.3 % of the total of 232 international papers, the Mexican scientists gave a UNAM affiliation. While the biomedical researchers, the astronomers and the geoscientists showed low frequencies of reporting foreign institutional affiliations (< 17 % of international papers), the chemists and the physicists were much more likely to do so (in 54.8 % and 35.7 % of cases, respectively).

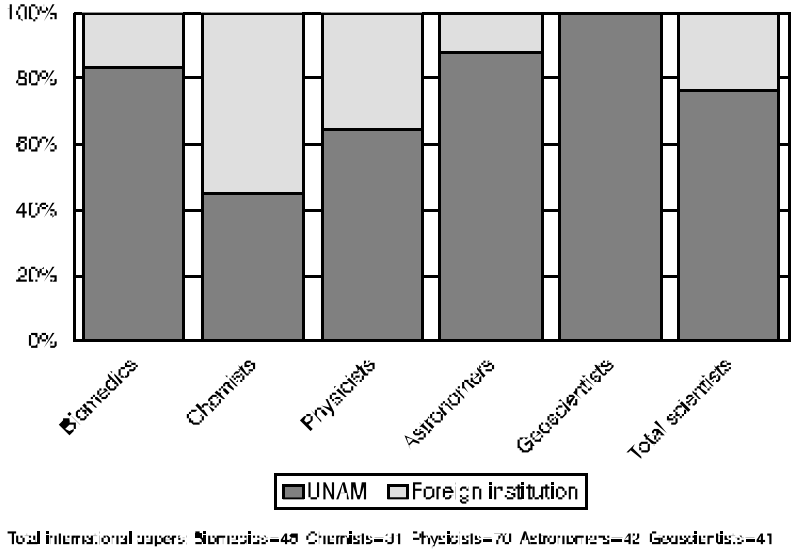


Figure 7. Institutional affiliations of the 15 scientists in 1980-1994 papers published in international collaboration

Papers coauthored internationally had a larger number of authors per paper than those published with no foreign collaboration (Figure 8). The international papers published by the astronomers and the physicists had the highest and the lowest number of authors per paper (5.2 and 3.4, respectively) while the chemists and the biomedical scientists showed the highest level of coauthorships with respect to papers written with national colleagues (4.4 and 3.8, respectively).

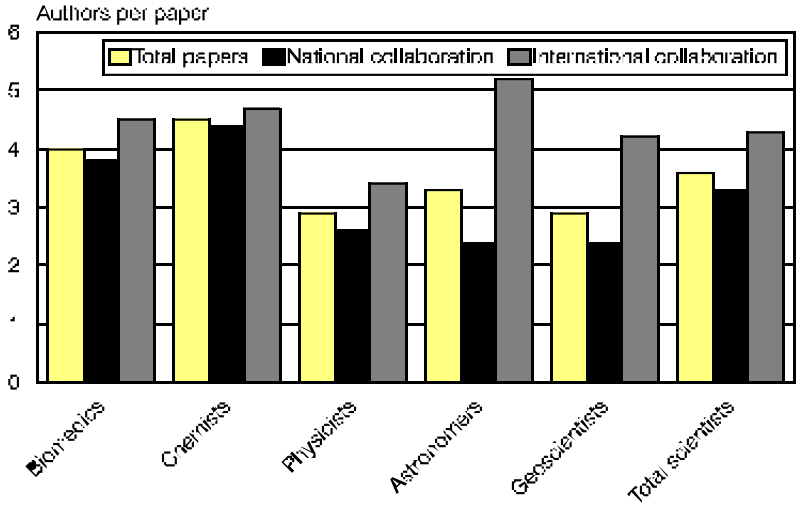


Figure 8. Number of authors per paper in national and international collaboration 1980-1994

Relationship between coauthorship and citation patterns of Physicist 1

Figure 9 shows the 1985 to 1993 citation pattern of Physicist's 1 papers published between 1985 and 1989. Self citations are not included. The number of citations showed a steep increase up to 1990 when they began to fall. Average citations per paper during this time was 3.8 The most cited paper received 25 citations with 7 papers receiving no citations during the nine-year window, three of which were articles published in a Mexican journal.

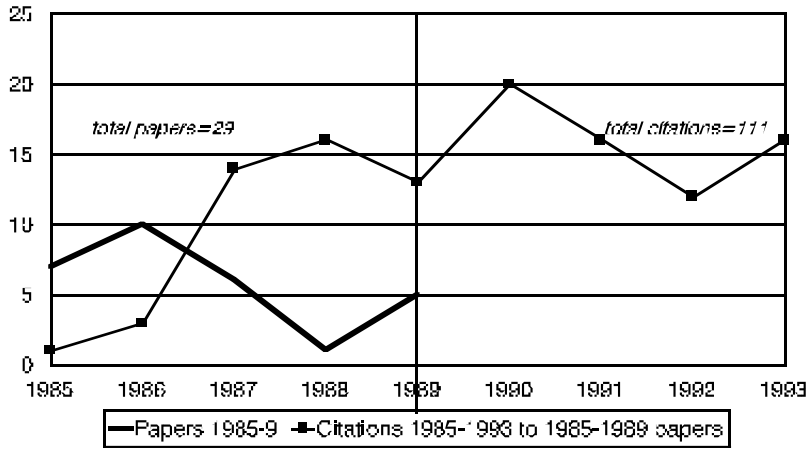


Figure 9. Production of papers and citations of Physicist 1

The country of most coauthorships with Physicist 1, the USA, was also the country giving the most citations to his papers during this time (Figure 10). Important levels of impact were seen in three European countries, Germany, the UK and Belgium, where institutional collaborations had also taken place. However, institutions in seven other countries also cited this physicist's work more than five times, although no collaborations between these and the UNAM scientist were apparent from the coauthorship patterns.

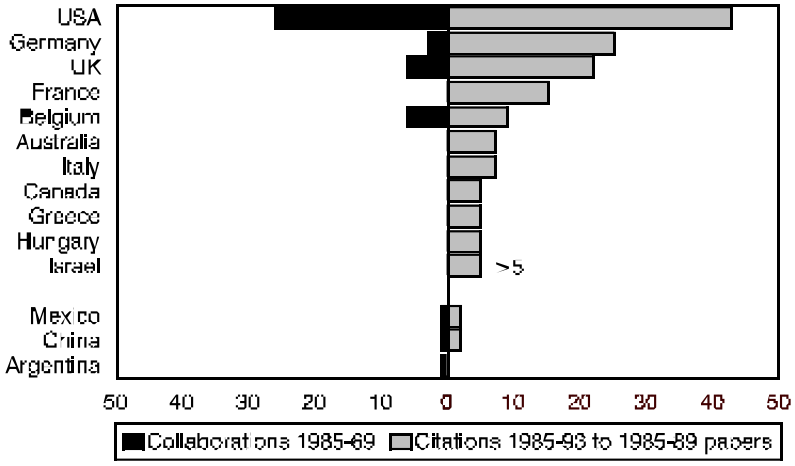


Figure 10. Institutional collaborations and citations of Physicist 1 according to country.

When looking at the relationship between collaborating and citing institutions, the dominant role played by one institution in particular, Yale University, is apparent (Figure 11). Physicist 1 spent two months as visiting researcher at Brookhaven National Laboratory towards the end of 1985, and eight months as a visiting professor at Yale in 1985-6. Coauthorships with the

Technische Universitât Mûnchen in Germany, the Science and Engineering Research Council in the UK, and the Instituut voor Nucleaire Wetenschappen in Belgium, also related to important citation rates by scientists at these institutions.

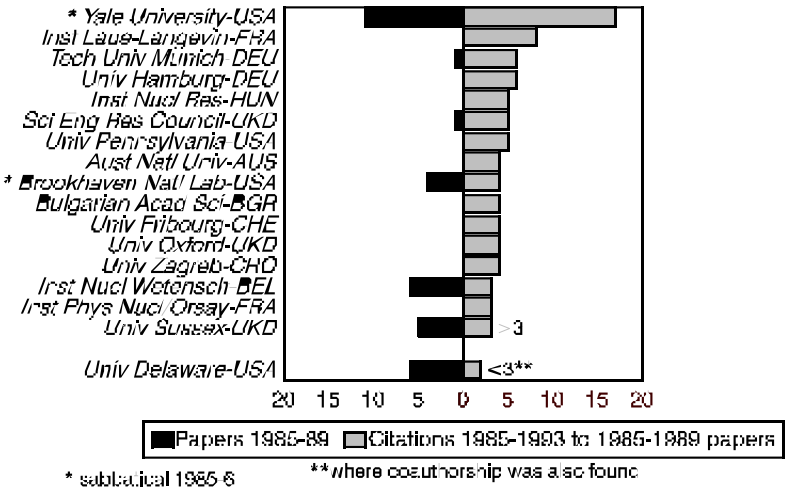
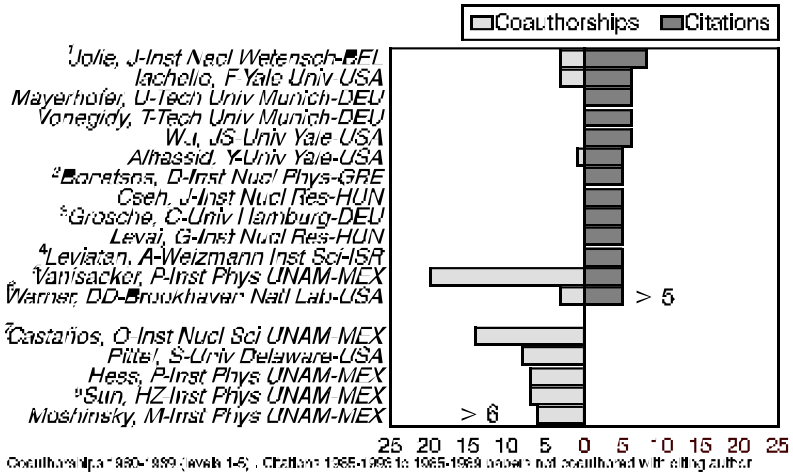


Figure 11. Institutional co-authorships and citations of Physicist 1 according to institution

At the level of individual researchers, Physicist 1's most frequent coauthor during this period was a colleague from his own university, but not from the same institute (Figure 12). This colleague cited other papers by Physicist 1 five times during this period. High levels of coauthorship with other colleagues from the UNAM was seen in the absence of citations (other than citations to the coauthored papers) from these coworkers to other papers by Physicist 1. Coauthors from Yale and Brookhaven, as well as scientists from institutes in several other countries, cited Physicist's 1 papers indicating a widespread influence of his research work. A high level of mobility was found in this group of scientists with eight of the coauthors reporting changes in institutional affiliations during this time, all of which also involved moves between countries and, in most cases, between regions.



Afterwards:

[1] Inst. Laue-Langevin-FRA [2] Univ Oxford-UKD [3] Imp Coll Sci Tech-UKD
[4]Yale Univ-USA [5] Univ Sussex-UKD/SERC-UKD/Univ Surrey-UKD
[6] SERC-UKD [7] Louisiana State-USA [8] Univ Drexel-USA/Univ Beijing-PRC

Figure 12. Collaborations and citations of Physicist 1 according to author

Discussion

The frequency of international collaboration in the papers by our sample of highly visible Mexican scientists, is comparable with that reported for Mexican science as a whole (Russell, 1995). In both cases, approximately 30 % of all papers (articles, notes, reviews, and letters) had at least one coauthor reporting foreign institutional affiliation. Also the number of papers in international collaboration showed a marked annual increase from 1980 onwards. In the particular case of the three physicists analysed in the present study, a higher level of international papers was found than that reported for physics research in Mexico as a whole (41 % for 1980-1994 as compared to 32 % for Mexico from 1980-1990). These results suggest a particularly high international profile for this group of UNAM physicists.

Results for the 15 scientists indicate that important collaborations are established with colleagues from the UNAM, suggesting that these highly visible scientists form part of established groups of scientists within their own institution. Pao (1992) found that global collaborators (those who in addition to collaborating within their own group, also coauthor with members of other groups) are more productive than those scientists who restrict their collaboration to their own local groups.

Collaboration patterns and scientific mobility are known to vary between fields. Mobility is typically less frequent in applied research than in basic fields (Carlson and Martin-Rovet, 1995). Scientists in basic fields achieve recognition from the international research community suggesting higher levels of international collaboration in these areas (Luukonen, et al., 1992) More applied fields can be expected to show higher levels of national collaboration, as is the case of biomedical research in the present study, although scientists in all five fields showed varying levels of international coauthorship.

Our results for the exact scientists suggests a direct relationship between number of papers published and the levels of international institutional collaboration. The evidence found in the particular case of Physicist 1 suggests that sabbaticals spent in institutions abroad not only boost levels of international coauthorship but also increase productivity. However, it is dangerous to generalise at this point on the evidence of one individual scientist. Preliminary analysis on the research trajectory of Physicist 2 indicate that a first sabbatical produced only one paper coauthored with the sabbatical institution, while a second period spent abroad produced much higher levels of coauthorships involving the UNAM scientist and colleagues from the foreign institution.

The technique of tracing author mobility by analysing the occurrence of institutional affiliations in published papers requires further study. It is possible to speculate from the present results that research disciplines where laboratory work is the norm, such as chemistry and physics, show higher incidences of foreign addresses because of time physically spent in foreign laboratories. In contrast, in disciplines where field studies are often carried out, such as in astronomy, and in the geosciences, the scientists tend to report the address of their home institution. Although there is an unwritten rule that scientists are expected to give as their institutional affiliation in the published report the address of the institute where the work was carried out, this is not always heeded (Day, 1988). It could also be that the accredited institution is where the work was written up which could well be the home institution. In some cases two institutional affiliations are noted, suggesting that both institutions were involved in the experimental procedure.

The fact that international papers have a greater number of authors suggests a variety of scenarios. The first concerns the involvement of both national and international colleagues in the work. This might be the case of the UNAM as coauthorships patterns suggest the presence of

important local collaborators. The second relates to the greater critical mass of scientists in industrialised countries in any one field, implying the availability of a greater number of collaborators for any one project. A third explanation could be the incorporation of the developing country scientists into big science projects, more characteristic of the scientifically advanced countries.

The case study of Physicist 1 suggests that international coauthorship can lead to increased international impact as measured by citations, as well as indicating the important role that sabbatical leaves of absence play in this process. The fact that this UNAM scientist forms part of a highly mobile group of scientists is most likely having a positive effect on his own visibility and opportunities for collaboration and mobility. In their study on scientific research in the Netherlands, Moed, de Bruin and van Leeuwen (1995) found that the highest values for three impact indicators referred to papers resulting from international collaboration, and the lowest for articles with no collaboration, once again suggesting that for peripheral countries, international collaboration is an important variable in performance evaluation.

These preliminary results from a small group of productive Mexican researchers suggest certain tendencies which merit further consideration. The next stage of this study is to measure the specific effect of prolonged stays abroad on the performance of these 15 scientists and to determine the effect of coauthorship on the citation patterns of all fifteen.

Acknowledgements
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The Emigration of Argentine Scientists: the Case of CONICET

Celina A. Lértora Mendoza

Introduction

Throughout it's existence, CONICET, which was founded in 1958, modeled on the CNRS of France, has found its efforts and investments in higher education to be partially thwarted because of the emigration process. This process has been evaluated differently according to ideological lines, and we lack a reliable history of the process, its causes and consequences, necessary in order to develop strategies to reverse it. Reconstructing this history implies the following difficulties that I mention because they explain the limits of the work that I am presenting.

1. CONICET does not have complete records of its own activities. The information that it provides to other organizations, i.e. the Secretary of Science and Technology, is only an estimate and should always be reviewed, which is not always done. Because of this, general official information or reports should be used with caution.
2. The Argentine system of science and technology does not have complete records and it does not allow to cross-check information on researchers. This can produce duplications when one person works in two institutions ; because of this the total numbers do not always coincide with the sums of the partial information.
3. There is a certain reticence on the part of the employees to provide a breakdown of official information for the reasons noted, and in the case of severance benefits, for policy reasons. The information is considered privileged and is not disclosed. Reports based on oral information are not considered to be very reliable, given that no distinction is made between being fired and voluntary resignations because of a fear of persecution. For this reason, the causes for leaving vary greatly.
4. In the reports, the research and the global projects, the identity of the scientific researchers are not always given and may include professors and the administrative employees of the research institutes, in such a way that the total numbers are inflated with respect to the strict partial numbers.

For my work, I employed only the following specific sources of information on CONICET, although I consulted relevant secondary bibliography :

The official reports of CONICET to the SECYT (punctual information on this subject given to the public or in answer to my questions).
Publications of the activities of the following institutions : the Boletín del CONICET, Directorios del CONICET, produced by the CAICYT, Quid, and Ciencia y Técnica.
Personal information provided by the researchers and employees (see the staff list in the Appendix)
Besides CONICET, I partially address the situation of the (CONEA) COMISIÓN NACIONAL DE ENERGÍA ATÓMICA (Argentine National Atomic Energy Commission), because of their close institutional connections and because it is the other most important scientific and technological institution, whose internal organization and research policies are quite similar.

Historical flow chart

Since it's foundation, CONICET has witnessed a permanent emigration process (Suter, Auza, Garrahan, Rimoldi). This is not a peculiarity of this institution, but rather the continuation of a process that was already perceptible starting in 1945 at the university (Rimoldi) and that was repeated during the 50's and 60's in CONICET (Bes). This migratory flow has peaks which are not homogeneous according to research areas nor categories. The highest incidence of emigration is found in physics, mathematics, and in some specializations of biology. The emigrants are young and well educated, and they are working on new projects with little development in the country.

The permanent flow of researcher emigration is not significant in numeric terms. In all of CONICET's history, fewer than 5 % of the researchers have left. Though in qualitative terms it has had significant impact because it affects the most qualified researchers (Auza Garrahan, Levin, Rimoldi).

With the application of the Law of being-the-least-essential [1] around 70 people were fired from CONICET, which was the major reason for leaving (Monterroso), this represents 7 % of the total personnel in that time (1976-1977). This number is consistent with the figure of 120 people have left (Casamiquela) because the former corresponds to the severance payments mentioned in an institutional resolution, whereas the second figure includes all of the resignations without there having been a previous enquiry plus those of scholarship holders, who do not appear on the pay-roll. Though they are legally hired, they do not receive severance pay (Sacco). In spite of these emigrations, in the 70's there was sustained growth at the Institute, the number of career researchers increased from 490 (1971) to 752 (1976) then to 1287 (1981) according to Monterroso's data.

With regard to recipients of foreign scholarships, during the last decade emigration has been stable at around 10 % (Sacco). Taking into account that during the same period the number of foreign scholarship holders varied from 150 to 200 per year and that the foreign scholarships are usually awarded for two year terms, it would seem that this was the greatest percentage of sustained, long term emigration (5-year periods).

The causes for leaving

From personal reports, as well as in the public opinion and my own experience as a member of the research system, there are three determining causes for leaving that I will name and go on to explain : political, economic and professional.

Political reasons

Political reasons are the external pressures put on the research system that place the researchers in a situation where it is not possible to continue in the workplace. These jobs are very precious and most of those who find themselves in this situation have no alternative but to emigrate. This reason is the most important because causes those who are well established in the institution to leave. These are persons who, if not facing this situation, would not normally leave and they are often the only ones who come back to stay when the situation changes (Garrahan,

Levin). Although it is an impacting reason, that transcends the public political and judicial sphere when it is very serious, in general those who were interviewed for this paper do not consider it to be a principal motive for leaving. For those who conceded that it has an impact, taking into consideration not only the severance payments but pressure and personal fears, this reason accounts for more than 50 % of the cases (Levin). There is an agreement among the researchers that repatriation projects are most successful with this group, but these initiatives fail if the person is forced to leave for a second time.

Economic reasons

This applies to cases in which earnings are very low and foreign offers are much greater. Researchers coincide in the fact that the number of emigrations exclusively attributable to this cause is very few. Most cannot cite even one case. But all of them point to this cause as an additional factor that may sway the decision to leave when there are grave professional difficulties (Garrahan). Besides, it has been shown that economic reasons motivate a kind of movement within the system, this is to say, that the researcher dedicates himself professionally to something else, that he emigrates locally. This is the case of scholarship holders and young researchers (categories that are very poorly paid) and this reason for leaving the research field is considered important (Auza, Bes, Garrahan, Levin).

Professional reasons

These are the most relevant, not only quantitatively but qualitatively. This is a structural cause that leads to the permanent desertion of the most qualified and promising researchers. There are several variations on this reason.

Internal Rivalry. This is quite a meaningful cause in the opinion of the scientists with whom we spoke. This may be based on the different ideological, religious or political affiliations of those involved but it is almost always exercised through interest groups that monopolize the directors of some centers in benefit of members of their group, leaving very little space for the professional development of others, and even leading to unfavorable evaluations “anybody who doesn’t think like me is wrong”). Researchers coincide that this cause not only produces emigration but also internal ostracism and can lead to the abandonment of the work when it becomes conflictive in a closed environment.

Deficiencies in the scientific system. This is the key cause, in the opinion of scientists and employees. The scientists, (Auza, Garrahan, Levin, Rimoldi), place emphasis on the systems for selection, evaluation, remuneration and the possibilities for development, which are obsolete and do not adequately reward the best people. This should be profoundly modified. The employees, (Camblong, Monterroso, Sacco), stress the defective and erratic global scientific policy, which does not state clear and permanent goals, hindering the organizations which are supposed to follow this policy (like CONICET) in order to effectively and permanently provide support to lengthy, complex research plans and they also mention apathy on the part of society and Argentine politics (Bes). It is clear that this cause cannot be disguised by the repatriation programs because returning researchers will just encounter the same unsatisfactory situation that they abandoned.

Evaluation of the causes

The political cause should be considered conjectural. Nevertheless, it could be said that the chronic instability of the institutions, the repeated breakdown of the political system, and its deficient functioning, constitute a weak and conflictive structural background that does not favor the development of scientific institutions. In this context the political causes may be considered structural.

More should be said about the economic cause. Although its gravity varies, it is always present in the labor situation. The successive adjustment policies and the restrictive measures, although presented in each case as being exceptional circumstances, altogether paint a picture of normalcy throughout CONICET's existence and whoever is starting out as a researcher has to face this reality. On the other hand, economic problems are not limited only to salaries, benefits and social services. They also cover investments and the diverse and necessary expenses for the development of the research. Positively evaluated and approved projects have had to be abandoned for an effective lack of funds. To work as a career researcher, the administrative paperwork takes 2 or 3 years to produce an answer in response to the application, and once the researcher has been accepted there can be another 3 or 4 year wait before effectively being received on the job. During this lapse, it is possible that candidates may opt for a more immediate job and then do not enter the company once their situation has been resolved, producing the "emigration of the system" that Auza mentions. Another negative outcome of these difficulties is the use of backroom deals to divvy up scarce funds and cut through red tape (Rimoldi). In the long term, this distorts the systems for evaluation and control, as well as the adequate and representative composition of the administrative bodies. [2]

The professional cause is specifically structural and, in the judgment of one writer (Rimoldi), it is an inherent defect that can be seen in CONICET, not only in the image of the French council but in favoring (though this was not Houssay's intention) a long tradition of authoritarianism and excessive verticality in the research relationships, where the director is a kind of patron (boss or godfather) of those he directs. Other writers (Rimoldi, Garrahan) mention that the criteria for evaluations are rigid and formal, and that seniority and quantitative factors prevail over qualitative ones, such as impact and scientific inventiveness, generating a sort of "gerontocracy" which puts the brakes on advancement, in such a way that many young and productive researchers do not feel that they are compensated properly. The system feeds back on itself producing a vicious circle that gets worse and worse. Scientists coincide that the goal of forming an elite of scientific excellence proposed by Houssay has not been sufficiently met. Also, it has been shown (Auza, Monterroso) that the general deficiencies of the education system and of the university make it difficult for CONICET to correct basic defects.

Recovery strategies

Official measures

"Measures to make someone take root." These are measures that tend to discourage researchers who are still in the company from emigrating for any of the causes indicated, with an emphasis on economic aspects. Throughout its history, CONICET has implemented several of these measures (Monterroso).

a) In its early years CONICET had funds donated by the Rockefeller Foundation. These funds were to provide individual subsidies of US $5,000 for scholarship holders from CONICET who returned to Argentina to work in their laboratories. In those days, a returned scholarship holder was assured of a job at the university. Later, when things didn't work that way, the returning graduate would embark on a research career and the subsidy would provide for the adequate technical equipment necessary for the research work.
b) Between 1967-68, CONICET came to an agreement with the Argentine National Mortgage Bank to provide loans — with very favorable conditions — so that staff could buy their own homes. Many loan applications were approved. Years later the SECYT tried something similar, of a more general nature. The results have not yet been evaluated.
c) In terms of CONICET's internal development, starting in 1972 measures were adopted to pay preferential salaries to researchers, according to their areas and specializations, stimulating the creation of institutes that would answer directly to CONICET (and not to the universities or other bodies, a criteria that undoubtedly was politically motivated). This involved 19 researchers in 1971 and increased to 100 in 1981. Unexpectedly, these measures tended to favor the process of putting down roots, by motivating young people and those who were highly capable, to stay or to take up disciplines that were not widely practiced.

Repatriation measures

These were incentives to motivate emigrated researchers (who previously were professors at the university) to return, by offering them high paying jobs and exclusive dedication to their fields within the universities. In 1961, the job title of career researcher was created and in accordance with the repatriation policy, this entitled the researcher to a bonus payment from CONICET, a return ticket and a subsidy to purchase equipment. In some cases, a contribution was also made to the university where the researcher went. In the 1961-1970 period, 31 researchers returned to Argentina under this program. Of these, only 3 emigrated before 1970, after staying several years.
b) After 1970, given the economic difficulties faced by researchers, CONICET increased the repatriation subsidy, paying the return tickets for the spouse and minor children, and a settlement allowance to cover the costs of getting installed in a dwelling. At this time more than 30 researchers returned. According to Monterroso, the level of demand for these subsidies was less than during the previous period, but in any case it is estimated that a number of very highly qualified scientists were among the 30 who returned. Also, considering that the general situation of the country in those days did not attract Argentines, in spite of everything, the plan is considered to have been quite successful. As a complement to the subsidies, CONICET requested and was granted that the customs service allow the returning scientists and technicians to bring in their scientific equipment and their personal possessions and goods duty free throughout the 1960's. Those repatriated by CONICET in those years could take advantage of this benefit which was also applied in other years : in 1977, 1990, etc. This measure is secondary to the others, because by itself it does not motivate people to return.
c) In Resolution No. 1636/87 of October 15, 1987, CONICET created the job title of "Corresponding Member of the Scientific and Technological Research Career" as an honorary title through which Argentine researchers who live abroad could return by invitation or at the request of an interested party. The resolution was based on the idea of formalizing the relationship of these researchers with CONICET and with the local researchers who were promoting their participation. The regulations established the requisites for becoming a member and the conditions for maintaining membership, and took into account the possibility that CONICET would hire them for short periods, paying them a salary as visiting researchers, the same salary that they would receive if they were to decide to take up residence again and be incor-

porated as regular members of the career at the same level. During 1988-89, CONICET formally admitted 47 researchers as corresponding members. Applications made later had not yet been answered at the end of 1994. At that same time, there was no evidence of activities being carried out in Argentina by any of the 47 designated members. According to Monterroso, Resolution 1636/89 purported to be a kind of complement to the CONICET career statute and this required a solid legal justification that was not forthcoming. It contained unpractical and unnecessary measures, it established a complicated evaluation system and was annoyingly incompatible with the needs of local researchers.

d) In Resolution No. 261 of August 1, 1990, the National Program of Association with Argentine Scientists and Technicians Abroad was created by SECYT (PROCITEX). Its goals are very broad because it applies to professional and technical fields. The project addresses the following points : the formulation of plans, the carrying out of the same, the creation of an emigration registry, the evaluation of antecedents, the promotion of scientific missions, the interaction with relevant organizations, the promotion of work contracts, evaluation and the paperwork for repatriation.

In the opinion of some researchers (Monterroso, Sacco) the proposals of the SECYT should be made systematic : It is not enough to come up with excellent proposals if deficient implementation generates frustration among the interested parties. Others (Garrahan, Camblong) are of the opinion that the results are distorted because there is no distinction made between a genuine emigrant and a temporary emigrant, the scholarship holder or a contract worker who would return in any case. Making this distinction would make it possible to observe a larger number of “repatriates” with a corresponding political interest. Also the criticism has been made that these resources seem to have been used indiscriminately, with no relation to the projects underway (Bes). All the writers coincided that the results of these programs, when seriously evaluated, are few (they did not attract the most qualified researchers) and this situation will not improve until there is a global policy and plans for taking advantage of local and foreign based Argentine resources.

Private sector measures

The private project that is the most important and has had the most impact in Argentina is that of the Antorchas Foundation, which provides reinstallation subsidies to post-doctorate scholarship holders — who are obliged to return — and this tends to offset the trauma of returning. The subsidy is between US $7,000 and $8,000. Part is given to the family as a group to cover personal expenses and does not have to be accounted for. The other part is approximately US $5,000 which is to be used to start the research project. The operation is quite easy and expeditious (Garrahan). About 20 subsidies a year are awarded, out of 100 to 120 requests coming from all of the disciplines and institutions. Other scholarships given by foreign institutions are also assigned funds to provide a settling in allowance to returning graduates.

The Antorchas Foundation also provides subsidies so that permanent residents abroad can repatriate. The sum available is more or less US $20,000, and requests are evaluated on a case by case basis. This subsidy has been in effect for the last five years and one or two are awarded per year. Once offered, this subsidy has never been turned down, given that the returnee will be guaranteed a job in the Argentine research system (CONICET or the universities). The two Antorchas projects are considered to be very successful (Bes).

In the foreign environment, an important initiative is that of ANACITEC, an Association of Argentine researchers resident in the United States, founded in 1985 (Garrahan). Its headquarters are in New York and its goal is to generally provide support to Argentine scientists. It does not expressly contemplate help for those who are considering returning, but works more in the area of local participation and addresses resolving specific problems related to Argentina. [3]

Conclusions

From the facts expressed here and from those that can be extrapolated, we draw several conclusions that we feel should guide more exhaustive future work on this subject.

1. Scientific emigration has been a constant in the history of our research institutions, as is shown in the paradigmatic cases of CONICET and CONEA, the two most important centers. In quantitative terms, this emigration has been low (at its highest it was only 7 %) but it is still qualitatively significant. In some disciplines (and in some specialized lines of work) it has been serious. Repatriation programs have had poor results, especially with regard to attracting the most qualified professionals.

2. Publicity in the media and the political use of the issue tend to blow the problem out of proportion and distort it, without focusing on the truly important points.

3. Constant emigration is caused by structural faults whose roots go way back and that affect the whole system. The fact that there have always been people who were not happy, did not conform and who decided to leave must be taken into account. A certain amount of loss is normal in any system, efficient and satisfactory as it may be. It is not reasonable to aspire to an emigration index of zero. But when a system is efficient and satisfactory it generates immigration that compensates for normal emigration. The Argentine problem is that this is not happening and the emigration of highly qualified researchers is higher than immigration or repatriation at the same level.

4. Evaluation of the losses should not be global but should make distinctions. The reasons for leaving may be due to causes that are different from those that we have mentioned here. I would like to mention some that have not been taken into account yet :

i) In a country with a strong influx of migrants, many Argentines are only first and second generation. These persons may be predisposed to return to the places of origin of their parents and grandparents.
ii) The present Argentine education system has become atomized and diversified in its proposals which do not motivate people to put down roots, something that is often observed in adolescents.
iii) There is a tendency in our culture to admire and mimic what is foreign. The desire to live in those admired places is compelling, even if it means putting up with the worst social or economic conditions. Emigration is an appreciable temptation for Argentine society, and not only for scientists.

5. It would be appropriate to undertake any analysis of scientific emigration with certain variables. As an example, I propose the following, which coincides in good measure with the opinions of some writers (Monterroso, Sacco) :

i) The emigrant’s degree of local insertion ;
ii) The point in the professional career achieved at the time of emigration ;
iii) The discipline cultivated or attempted to cultivate with exclusive dedication ;
iv) Possibilities for advancement in Argentina ;
v) Possibilities for advancement abroad.

An analysis of these variables would provide another perspective on the problem, one that is based on the reality and that would permit more efficient policies for putting down roots that are definitely in our interest. Also positive relations should be promoted (both professional and personal) with the emigrants, with no anger or false sentiments, and as I did for this report, consultative meetings should be held with scientists and employees who have extensive experience and from whom we can all learn.

Appendix: personal reports

The specific data contained in each report is indicated. General observations and assessments have been included in the text. The lists of emigres presented have some overlap, thus their total must be reduced by approximately 15 %.

Nestor Tomas Auza. Historian, CONICET researcher, has been on the CONICET management and has participated in Evaluation Commissions.
Provided general information on educated scientists who received scholarships in various disciplines, especially human sciences, but also physics, chemistry and biology. Period covered 1980-1995.

Daniel R. Bes. Physicist, researcher of the Department of Physics at CONEA, President of the Argentinean Physics Association.
Provided information on recipients of scholarships and researcher education based on people he worked or associated with since 1971, in the area of theoretical nuclear physics. Of a total of sixteen who were preparing their theses, eight from the UBA resigned in 1966 and seven emigrated, of which five returned during the next two to fifteen years. From CONEA, eight who were preparing their theses resigned, six emigrated and only two returned. In general, they remained away for purely professional reasons. He mentions cases of scientists who returned at the promise of projects which turned out to be non-existent, generating great indignation.

Alfonso Camblong. Chemist, CONICET employee since 1971, he has held different offices, currently he is retired. He provided information on all the disciplines as he has come into contact with many cases through his duties. The period he discussed covers the fifteen years during which he was Head of the Department of Institutes. He provided personal knowledge of thirteen cases of emigrated Argentineans, all of whom are making or did make a significant contribution in foreign centers : twelve men, one woman, of whom there were five physicists, two mathematicians, one engineer, one chemical engineer, one geologist, one physician. Their destination countries were : United States (eleven) and Italy (two). Of the eleven who went to the United States, one moved later to Canada, another returned to Argentina (the only one of the thirteen), two are working in private business applying their scientific knowledge, one is in the OAS and the rest are in universities.

Rodolfo Casamiquela. Paleontologist and anthropologist, CONICET researcher, Director of the National Patagonian Center. He provided information on emigrated scientists who did not return, in connection with his field of specialization and through personal knowledge. Of ten researchers : one physician, two biologists, one palinologist, one botanist, two geologists, two anthropologists and one paleontologist, eight were men and two were women. The destination countries were Brazil, Spain, France and the United States. Some have made significant contributions to CNRS and NASA. Causes for departure : policy reasons (loss of job, morale) : five, professional reasons : two, dissatisfaction with the country in general : two, reasons unknown : one. Those that he knew personally who emigrated for political reasons (actual or presumed) (during the ‘70’s) returned in 1984. He estimates that 120 people resigned from CONICET for this reason in 1976-77.

Patricio Garrahan. Biologist, Director of the Department of Biological Chemistry of CONICET. Member of the Antorchas Foundation Commission for repatriation subsidies. He provided information on his department during the period since 1970. Almost all the people who completed doctoral degrees have left, five in his immediate work group and more in the rest of the organization. He estimates that these emigrations represent a very important loss. None returned. He personally knows of other cases in which the return was traumatic : cases of dismissals in 1966, who returned and were again fired in 1976 ; emigres who returned in response to promises that were never met, etc.

Emanuel Levin. Biochemist, CONICET researcher, founder and Secretary of the first Managing Commission of the ASDICYT (Argentinean Association of Scientific and Technological Researchers). Provided information on various disciplines, through personal knowledge and through his affiliation with the Association for the period 1974-1994. He knows twenty scientists who emigrated, five were recipients of scholarships and the rest were professionals who had completed their studies, most of whom belonged to CONICET and to the University of Buenos Aires, in the areas of biological, medical and physical sciences. He has no evidence that they would have returned, even had they known about the repatriation programs.

Jose A. Monterroso. Retired CONICET official, where he worked for almost 30 years, retiring in 1992. He held several offices, the last of which was Advisor to the Management.
He provided information on the period 1962-1983. The data, drawn from documentation he managed in the institution, appears in the text.

Horacio Rimoldi. Physician, specialist in mathematical psychology, scholar in Medicine and Education. Director of the CIIPME (Interdisciplinary Center for Research in Mathematical and Experimental Psychology).
Provided information from 1975 onwards, based on his own knowledge of the University and later CONICET, he being an emigre who returned. He knows of twenty-three cases of highly qualified Argentineans from various disciplines who moved abroad, of which only two returned, one of them, Mr. De Robertis, at the end of his career.

Liliana Sacco. Professor, Head of the Department of Foreign Scholarships at CONICET, with ten years of experience in this area. Provided information on beneficiaries of foreign scholarships in the period 1985-1995. In this period and for scholarship recipients the causes for departure are mainly professional and there are some peaks that are followed by periods of retraction as some return to enter CONICET as career researchers.

Tito Suter. Physicist, researcher, retired from the CONEA, currently Director of the CAICYT, Center of Scientific and Technological Information of the National Secretariat of Science and Technology. Provided information on CONEA in the time of the military presidents (Rear Admirals Quihillalt and Castro Madero). He points out that CONEA at that time did not have any problems with internal professional rivalries because the military management were removed from them and had their own criteria for management, hiring personnel, selecting projects, making investments, and approving education abroad. With respect to labor law, the lists for dismissals came from the upper political echelons. Regarding detentions (and later disappearances) some happened in the work place, but the perpetrators were unknown to CONEA. He witnessed that Castro Madero himself arranged for the release of several people who were arrested, in some cases with success, but his own military staff disobeyed him.

[1] During the Military government 1976-1982, this was the policy. This policy introduced by the Military Junta that allowed people to be fired without an enquiry and was used against people who belonged to the political opposition (although is has been denounced that a significantly high number of firings took place for personal issues beyond politics, between 10 % and 20 %) There is a lot of controversy surrounding the real impact of this assertion. There are no hard figures as it seems that the institutions have not kept strict accounts. The lists that at that time were handled by CONICET as Levin mentions, were made from oral reports and are therefore not very reliable.

[2] Rimoldi shows that of the 15 members of the present CONICET executive, ten are physicians or biologists, which means that these disciplines are over-represented in relation to other disciplines. Situations such as these do not favor the multi disciplinary environment that is essential to an organization like CONICET, and that now has on its executive no physicists, no astronomers, no sociologists, no psychologists, no specialists in education, no mathematicians, and only one historian to represent all the fields of the social sciences. With the complete change of evaluators and of the authorities that occurred in 1984, the formation of these boards depended more on political tendencies than on area of work, and various lines of work were left without any representation.

[3] For example, Garrahan shows that one of their presidents (in 1995), Dr. Victor Penchasedeh, a geneticist, worked on identifying children of people who had disappeared, children who had been given to new families.

Emigración de científicos argentinos El Caso CONICET

Celina A. Lértora Mendoza

Introducción

A lo largo de su gestión, el CONICET -creado en 1958, según el modelo del CNRS francés- ha visto parcialmente malogrados los esfuerzos e inversiones en la formación de alta calificación debido a procesos emigratorios, diversamente evaluados debido a su vinculación ideológica, y sin una historia confiable del proceso mismo, de sus causas, consecuencias y estrategias de reversión. Reconstruir esta historia tiene las siguientes dificultades que debo señalar porque explican a la vez los límites de este trabajo que presento :

1. El CONICET no tiene registros completos de su propia actividad. La informacion que suministra a otros organismos, por ej. la Secreetaría de Ciencia y Técnica, es estimativa y debe ser revisada en cada caso, lo que no siempre se hace. Por eso los informes oficiales generales deben ser usados con mucha prudencia.
2. El sistema argentino de ciencia y tecnología tampoco tiene revistros completos ni depura los elencos de investigadores. Pueden producirse duplicaciones tanto de altas como de bajas, cuando el mismo gente revista a la vez en dos instituciones; por eso las cifras totales no siempre coinciden con las sumas de las informaciones parciales.
3. Existe una cierta reticencia por parte de los funcionarios a dar información oficial discriminada, por los motivos apuntados y en los casos de cesantías por razones políticas, la información se considera reservada y no se suministra. Los informes basados en información oral son considerados poco seguros por los funcionarios, dado que no discriminan entre sanciones y retiros voluntarios ante una apreciación subjetiva de persecusión. Por esta razón la evaluación de las causales resulta disímil.
4. En los informes, investigaciones y proyectos de nivel global no siempre se discrimina exactamente quién es investigador científico, e incluye a profesores y funcionarios directivos de organismos de investigación, de modo que las cifras totales quedan aumentadas con respecoto a las parciales estrictas.

Para mi trabajo me he valido sólo de las siguientes funtes específicas para CONICET, aunque he consultado la bibliografía secundaria atinente :

- Informes oficiales del CONICET o de la SECYT (informaciones puntuales sobre este tema emitidas en forma pública o como respuesta mi solicitud).
- Publicaciones de difusión de actividade de estas instituciones : Boletín del CONICET, Directorios del CONICET elaborados por CAICYT, Quid, y Ciencia y Técnica.
- Informes personales de investigadores y funcionarios (ver elenco en el Apéndice)

Además de CONICET, incluyo parcialmente la situación en la Comisión Nacional de Energía Atómica (CONEA) por sus estrechas conexiones institucionales y porque es, junto con aquél, la institución más importante de investigación científica y técnica, con un sistema interno y una política de investigación bastante similares.

Cuadro histórico del flujo

Desde su creación el CONICET ha sufrido un proceso permanente de emigración (Suter, Auza, Garrahan, Rimoldi). Esto no es una peculiaridad de esa institución, sino que continúa un proceso ya perceptible a partir de 1945 en la Universidad (Rimoldi) y que se repite en ella en la década del 50 (Suter) y en el 60 también en CONICET (Bes). En este flujo hay picos, que no son homogéneos en las áreas ni en las categorías. La incidencia mayor se registras en física, matemáticas y algunas especialidades de biología. Los emigrantes « estructurales » pertenecen a los cuadros más jóvenes y trabajan en proyectos nuevos de alta capacitación con poco desarrollo en el país.

El flujo emigratorio permanente de investigadores no está cuantificado. En términos porcentuales no ha llegado al 5 % en toda la historia del CONICET, si bien en términos cualitativos se produce en la esfera de máxima cualificación (Auza, Garrahan, Levin, Rimoldi), por lo que su impacto es mucho mayor.

Por aplicación de la « Ley de prescindibilidad » [1] los cesanteados en CONICET (la mayoría de los cuales emigró) fueron alrededor de 70 (Monterroso), lo que representa el 7 % del personal total de ese momento (1976-1977). Esta cifra puede compatibilizarsse con la de 120 (Casamiquela) porque se refiere a las cesantías por resolución institucional, mientras que la segunda incluye a todos los retiros sin que necesariamente hubiera expediente previo, y a becarios, que no son agentes de plantilla sino que tienen el estatuto jurídico de contratados y no se les aplicaron cesantías (Sacco). A pesar de estas emigraciones, la década del 70 fue de sostenido crecimiento del plantel : los investigadores de Carrera aumentaron de 490 (1971) a 752 (1976) y a 1287 (1981) según datos de Monterroso.

En cuanto a los becarios externos, desde hace una década la emigración se mantiene estable en alrededor de un 10 % (Sacco). Teniendo en cuenta que en igual período los becarios externos oscilan entre 150 y 200 por año y que las becas externas son habitualmente bianuales, pareciera que estamos en presencia del mayor porcentual de emigración estable por períodos largos (quinquenios).

Causales del alejamiento

En los informes personales, así como en la estimación pública y mi propia experiencia como miembro del sistema de investigación, hay tres causales determinantes de los alejamientos que denomino políticas, económicas y profesionales y que paso a explicar.

Causas políticas

Llamo así a las presiones externas al sistema de investigación, que colocan al agente en situación de no poder continuar en el lugar de trabajo que tenía, y siendo estos muy escasos, para la mayoría no queda otra alternativa que la emigración. Esta causal es importante porque provoca el alejamiento de los « afincados », es decir, de los que si no fuera por esta situación no se hubiesen ido y que suelen ser los únicos que efectivamente regresan y se quedan cuando las situaciones revierten (Garrahan, Levin). Aunque es una causal impactante, que trasciende a la esfera pública política y jurídica cuando es muy grave, en general los informantes no la consideran una causa principal. Quienes más le conceden, tomando en consideración no sólo las

cesantías reales sino las presiones y los miedos personales, no le adjudican más que el 50 % de los casos (Levin). Hay acuerdo de informantes en que los mayores éxitos de los proyectos de repatriación se producen en este grupo, pero fracasan cuando el agente ha tenido que irse por segunda vez.

Causas económicas

Se trata tanto de los casos en que el estipendio es muy escaso o cuando las ofertas externas son muy superiores. Los informantes coinciden en que el número de emigraciones por esta exclusiva causa es escasísimo. La mayoría no conoce ningún caso. Pero todos señalan que es una causa sumatoria que puede determinar la decisión de alejamiento cuando median dificultades profesionales graves (Garrahan). Además se señala que la causal económica produce la « emigración » del sistema mismo, es decir, el agente pasa a dedicarse profesionalmente a otra cosa, sea que emigre localmente o no. En el caso de becarios e investigadores jóvenes (categorías con remuneraciones muy bajas) esta causal de abandono de la investigación es considerada importante (Auza, Bes, Garrahan, Levin).

Causas profesionales

Son las más relevantes, no sólo cuantitativa sino cualitativamente. Es una causa estructural que determina una permanente deserción de los cuadros investigativos en sus niveles más calificados y más promisorios. Podemos señalar las siguientes variantes de esta causal :

- La rivalidad interna es una causa bastante significativa a juicio de los informantes científicos. Puede deberse a diversa filiación ideológica, religiosa, política, etc. de los implicados, pero casi siempre se ejerce a través de « grupos » de interés que monopolizan la dirección de algunos centros en beneficio de sus miembros, dejando poco espacio de realización profesional a los demás, determinando hasta evaluaciones desfavorables («quien no piensa como yo está equivocado »). Los informantes coinciden en que esta causa no sólo produce emigraciones sino también ostracismos internos e incluso el abandono de una línea de trabajo que se torna conflictiva en un medio muy pequeño.
- Las deficiencias del sistema científico. Esta es una causal clave, a juicio de científicos y funcionarios. Los científicos (Auza, Garrahan, Levin, Rimoldi) ponen el acento en los sistemas de selección, evaluación, gratificación y posibilidades de desarrollo, que son obsoletos, que no gratifican adecuadamente a los mejores y que deberían modificarse profundamente. Los funcionarios (Camblong, Monterroso, Sacco) acentúan la defectuosa y errática política científica global, que no fija metas claras y permanentes y que impide a los organismos ejecutores (como el CONICET) apoyar con efectividad y continuidad planes de investigación largos y complejos e incluso el desinterés de la sociedad y los políticos argentinos (Bes). Está claro que esta causal no puede ser paliada con sistemas de repatriación, porque quien regrese encontrará la misma situación insatisfactoria que dejó.

Evaluación de las causales

La causal política debería ser considerada coyuntural. Podría decirse, sin embargo, que la inestabilidad crónica de las instituciones, la quiebra reiterada del sistema político e incluso su deficiente funcionamiento, constituyen un transfondo estructural endeble y conflictivo que no favorece el desarrollo de las instituciones científicas. En ese sentido las causas políticas pueden considerarse estructurales.

Otro tanto debe decirse de la causal económica, que si bien tiene picos de gravedad, está siempre presente en el marco laboral. Las sucesivas políticas de ajuste y las medidas restrictivas, aunque presentadas en cada caso con caracter excepcional, en su conjunto abarcan con regularidad toda la vida del CONICET y quien se inicia como investigador tiene que contar con ellas. Por otra parte, los problemas económicos no se reducen sólo a sueldos, remuneraciones especiales y servicios sociales. Abarcan también los insumos y gastos diversos y necesarios para el desarrollo de la investigación. Proyectos evaluados positivamente y aprobados no se han podido realizar por falta efectiva de fondos. Para ingresar a Carrera del Investigador el mecanismo administrativo tarde 2 ó 3 años en resolver el pedido y el agente aceptado a veces debe esperar otros 3 ó 4 años para ingresar efectivamente. En ese lapso es posible que los postulantes opten por un trabajo más efectivo y luego no ingresen, produciéndose la « emigración del sistema » que señala Auza. Otro efecto negativo de estas dificultades es el recurso al « amiguismo » para repartir fondos escasos y acelerar trámites engorrosos (Rimoldi), lo que distorsiona a la larga los sistemas de evaluación y control, así como la composición adecuada y representativa de los órganos directivos [2].

La causal profesional es específicamente estructural, y a juicio de un informante (Rimoldi) es un defecto constitutivo de CONICET, que no sólo se constituyó a imagen del Consejo francés sino que favoreció (que no era la intención de Houssay) una larga tradición de autoritarismo y excesiva verticalidad en las relaciones investigativas, donde el director es una especie de « patrón » del dirigido. Se señala también (Rimoldi, Garrahan) que los criterios de evaluación rígidos y formales, en que la antigüedad y el aspecto cuantitativo prevalecen sobre el cualitativo, el impacto y la inventiva científica, generan una cierta « gerontocracia » que frena ascensos, de modo que muchos investigadores jóvenes y productivos no se sientan recompensados. Este sistema se realimenta produciendo un anquilosamiento cada vez más grave. Los informantes científicos coinciden en que la meta de formar una élite de excelencia científica que proponía Houssay no se ha cumplido suficientemente. También se señala (Auza, Monterroso) que las deficiencias generales del sistema educativo y de la Universidad hacen difícil para el CONICET subsanar fallas de arrastre.

Estrategias de recuperación

Medidas de la esfera oficial

Medidas de arraigo. Son las tendientes a evitar que el investigador que todavía está en plantel, emigre por cualquiera de las causales indicadas, con énfasis en el aspecto económico. A lo largo de su historia, el CONICET implementó varias (Monterroso) :

a) En los priemeros años CONICET dispuso de fondos donados por la Fundación Rockefeller, destinados a otorgar subsidios individuales de $USA 5.000 a los becarios del CONICET que retornaban al país para la instalación de sus laboratorios. En aquella época el regreso del becario implicaba un cargo seguro en la Universidad. Más tarde, cuando ya no sucedió asi, este complemento de la beca era el ingreso a la Carrera del Investigador y el subsidio le aseguraba la adquisiciónde medios técnicos adecuados para su trabajo.
b) Entre 1967/8 CONICET acordó con el Banco Hipotecario Nacional el otorgamiento de créditos -en condiciones muy favorables- a miembros de la Carrera para adquirir vivienda propia. Hubo numerosas solicitudes concedidas. Años después la SECYT intentó algo semejante, con caracter más general. No constan los resultados.
c) En la esfera de competencia interna de CONICET, a partir de 1972 se instrumentaron medi-

das para pagar sueldos preferenciales a los investigadores, según regiones y especialidad, impulsando la creación de Institutos que dependen directamente de CONICET (y no de las Universidades u otros organismos, criterio en que hubo sin duda un cálculo político) que pasaron de 19 en 1971 a 100 en 1981. Estas medidas tendían indirectamente a favorecer el arraigo, aunque sus resultados para motivar a los jóvenes y más capaces a permanecer o emprender disciplinas poco cultivadas no fue el esperado.

Medidas de repatriación

Son las que propenden al regreso de investigadores ya desvinculados del CONICET y que desean reinsertarse en el sistema. Históricamente se tomaron diversas medidas (Monterroso).

a) Desde su instalación en 1958, el CONICET trató de motivar el retorno de investigadores emigrados (antes profesores de la Universidad) ofreciendo cargos bien remunerados con dedicación exclusiva dentro de la jurisdicción de las Universidades. En 1961 abrió la Carrera del Investigador y en su marco implementó una política de repatriación que implicaba el pago, por parte del CONICET, del pasaje de regreso y un subsidio para equipamiento. En algunos casos contribuía también la Universidad donde se ubicaba. En el período 1961-1970 regresaron al país de este modo 31 investigadores. De ellos sólo 3 emigraron antes de 1970, luego de varios años de permanencia.

b) Después de 1970, dadas las dificultades económicas de los investigadores, el CONICET amplió el subsidio de repatriación, pagando el pasaje de regreso a la esposa y los hijos menores de edad y un monto para gastos de instalación doméstica. En esta época regresaron por este plan unos 30 investigadores. Según Monterroso, el nivel de exigencia científica para otorgar estos subsidios decayó en relación al período anterior, no obstante estima que se incorporaron varios científicos muy calificados de entre esos 30. Considera también que las condiciones generales del país en esos años no atraían a los argentinos, por lo cual a pesar de todo el plan puede considerarse bastante exitoso. Como un apéndice de los subsidios, aunque no a cargo directo del CONICET sino a su pedido, tenemos las franquicias aduaneras durante la década del 60, que permitían introducir libremente equipamiento científico y pertenencias personales a científicos y técnicos argentinos radicados en el exterior que regresaban. Los repatriados por el CONICET en esos años pudieron usufructuar el beneficio que se aplicó también en otros períodos : en 1977, 1990, etc. Esta medida es subsidiaria de las otras, pues de por sí no produce ningún efecto de retorno.

c) Por Resolución Nº 1636/87, del 15 de octubre de 1987, el CONICET creó la categoría de « Miembro Correspondiende de la Carrera del Investigador Científico y Tecnológico », en la cual son designados, a título honorario, investigadores argentinos residentes en el exterior, pudiendo ingresar por invitación o a solicitud del interesado. La Resolución se fundamenta en la conveniencia de formalizar vínculos de ellos con el CONICET y con los investigadores locales promoviendo su participación. La Reglamentación establece los requisitos de ingreso y condiciones de permanencia, considerando la posibilidad de que CONCIET los contrate por breves períodos pagándoles como visitantes el mismo estipendio que corresponde a la categoría en que revista y si deciden radicarse otra vez en el país, pueden ser incorporados como miembros regulares de la Carrera en la misma categoría. Entre 1988 y 1989 el CONICET admitió formalmente a 47 investigadores como Miembros Correspondientes. Solicitudes presentadas con posterioridad no habían sido evacuadas hasta fines de 1994. En la misma fecha no había constancias de actividades realizadas en Argentina por ninguno de los 47 designados. Según Monterroso, la Resolución 1636/89 pretendía ser una especie de Apéndice del Estatuto de la Carrera del CONICET, y esto requería un sólido sustento jurídico que no está expresado ; contiene medidas inecesarias y/o inviables, crea un complicado sistema de evaluaciones e instaura un régimen de compatibilidades irritativamente desigual con respecto al que se le exige al investigador local.

d) Por Resolución Nª 261 del 1 de agosto de 1990, la SECYT creó el Programa Nacional de Vinculación con Científicos y Técnicos Argentinos en el Exterior (PROCITEX). Sus objetivos son amplios, porque se extiende a los campos profesional y técnico. Se contemplan en el proyecto los siguientes puntos : formulación de planes, ejecución de los mismos, relevamiento y confecciones de registro de emigrados, evaluación de antecedentes, promoción de misiones cientíicas, interacción con organizaciones vinculadas, fomento de contratos de trabajo, asesoramiento y trámites de repatriación.

A juicio de algunos informantes (Monterroso, Sacco) las propuestas de la SECYT deberían organizarse ; no basta con enunciar excelentes propósitos, porque su implementación deficiente genera frustración en los interesados. Otros (Garrahan, Camblong) opinan que los resultados están distorsionados porque no se discrimina entre el emigrado genuino y el transitorio (el becario o el contratado temporal que de cualquier modo regresaría) y así se logra exhibir un mayor número de « repatriados » con su correspondiente rédito político. También se objeta que esos recursos parecen haber sido usados indiscriminadamente y sin conexión con los proyectos vigentes (Bes). Y todos coinciden en que los resultados de estos planes, seriamente evaluados, son escasos (no atraen a los más calificados) y que no mejorarán mientras no haya una política global de aprovechamiento de los recursos argentinos locales y externos.

Medidas en la esfera privada

El proyecto privado más importante y consecuente, a nivel argentino, es el de la Fundación Antorchas que concede subsidios de reinstalación a los becarios de postdoctorado -que tienen obligaciójn de volver- y tiende a evitar los traumas del retorno. Es una suma de dinero que oscila entre $USA 7.000 y 8.000. Una parte se destina a gastos personales (no requiere rendición de cuentas) y se otorga de acuerdo al grupo familiar ; otra, de $USA 5.000 aproximadamente, es para comenzar un proyecto de investigación. El funcionamiento es bastante fácil y expeditivo (Garrahan). Se pagan unos 20 subsidios por año, sobre unas 100 ó 120 presentaciones, de todas las disciplinas e instituciones. Otras becas otorgadas por instituciones extranjeras también tienen asignados fondos para ayudar el regreso.

Además la Fundación Antorchas tiene subsidios de repatriación para residentes permanentes en el exterior. Genera un monto de más o menos $USA 20.000 que se evalúan caso por caso. Este subsidio se otorga desde hace cinco años y se han otorgado uno o dos por año. No se han rechazado pedidos, son los que se presentan, teniendo ya una ubicación segura en el sistema investigativo argentino (CONICET o Universidades). Los dos emprendimientos de Antorchas son considerados muy positivamente (Bes).

En el ámbito externo, un emprendimiento importante es ANACITEC, una Asociación de investigadores argentinos residentes en Estados Unidos, fundada en 1985 (Garrahan). Tiene su sede en Nueva York, y sus finalidades son de apoyo general a los científicos argentinos. No contempla expresamente ayudas para el regreso, sino más bien para la inserción local o para solucionar algunos problemas específicos vinculados con Argentina [3].

Conclusiones

De los datos aquí expresados y de los extrapolables con buena probabilidad podemos extraer algunas conclusiones que a nuestro juicio deben guiar futuros trabajos más exhaustivos sobre este tema.

1º. La emigración científica ha sido una constante en la historia de nuestras instituciones investigativas, como lo muestran los casos paradigmáticos de CONICET y CONEA, sus dos centros más importantes. Esta emigración ha sido cuantitativamente reducida (llegando en su mayor pico sólo al 7 %) pero cualitativamente significativa. En algunas disciplinas (y en algunas líneas complejas de trabajo) puede considerarse grave. Las medidas de recuperación tienen resultados escasos, sobre todo en los niveles más calificados.

2º. La información de los medios y el uso político de la cuestión tienden a sobredimensionar el problema o a distorsionarlo, sin enfocar los puntos realmente importantes.

3º. La emigración constante está determinada por fallas estructurales de largo arrastre que afectan al sistema en su conjunto. Hay que considerar el hecho de que siempre habrá disconformes que decidan irse, es decir, que cierta pérdida es normal en cualquier sistema, por eficiente y satisfactorio que sea, por lo que no puede aspirarse razonablemente a un índice cero de emigración. Pero cuando un sistema es eficiente y satisfactorio genera inmigraciones que compensan las emigraciones normales. El problema argentino es que esto no sucede y que los índices de emigración altamente calificada superan a los de inmigración o repatriación en iguales niveles.

4º. La evaluación de las pérdidas no puede ser global sino matizada. Las razones del desarraigo pueden deberse a causales distintas a las que aquí hemos mencionado como específicas.

Quisiera señalar algunas que no se han tenido en cuenta todavía :

a) En un país con fuerte inmigración, muchos argentinos lo son sólo de primera o segunda generación. Estas personas están predispuestas a regresar a los lugares de origen de sus padres o abuelos.
b) El actual sistema educativo argentino se ha atomizado y diverisificado en propuestas que no motivan al arraigo, lo que se aprecia ya en los adolescentes.
c) Existe una tendencia en nuestra cultura al mimetismo y la admiración por lo foráneo, que se canaliza en deseos de vivir en los lugares admirados, incluso en peores condiciones sociales o económicas. La emigración es una tentación apreciable en la sociedad argentina y no sólo entre los científicos.

5º. Sería conveniente precisar con ciertas variables todo análisis de emigración científica. A título de ejemplo propongo la siguiente, que coincide en buena medida con las opiniones de algunos informantes (Monterroso, Sacco) :

1. Qué grado de inserción local tenía el emigrante
2. En qué etapa de su carrera emigró
3. Qué disciplina cultivada o intentaba cultivar con dedicación exclusiva
4. Qué posibilidades tenía en Argentina
5. Qué posibilidades tenía en el extranjero

Quizá un análisis de estas variables muestre otra visión del problema más ajustada a la realida y permita trazar políticas más eficaces de arraigo, que en definitiva es lo que interesa. También debiera promoverse una vinculación positiva (profesional y afectivamente) con los emigrados, sin rencores ni falsas emulaciones, y -como hice yo para este informe- promover reuniones de consulta con científicos y funcionarios de larga experiencia, lo que será beneficioso para todos.

Apendice : Informes personales

Se señalan los datos puntuales contenidos en cada informe. Las apreciaciones globales y evaluaciones han quedado incluídas en el texto. Las listas de emigrados que presentan tienen algunas superposiciones por lo cual debe reducirse su total en aproximadamente un 15%.

Néstor Tomás Auza. Historiador, investigador del CONICET, ha sido miembro de su Directorio y de las Comisiones Evaluadoras. Informa globalmente sobre científicos formados y becarios, en diversas disciplinas, sobre todo Ciencias humanas, pero también Física, Química y Biología. Período abarcado 1980-1995.

Daniel R. Bes. Físico, invesetigador del Departamento de Física de CONEA, presidente de la Asociación Física Argentina. Informa sobre becarios e investigadores en formación que trabajaron o tuvieron relación con él, desde 1971, en el área de física nuclear teórica. Sobre un total de 16 tesistas, 8 de UBA renunciaron en 1966 y 7 emigraron, de los cuales 5 regresaron entre los 2 y 15 años siguientes. De CONEA, 8 tesistas renunciaron, 6 emigraron, y sólo 2 regresaron. En general se quedaron fuera por razones exclusivamente profesionales. Señala casos de científicos que regresaron ante promesas de proyectos inexistentes, generando gran indignación.

Alfonso CamblongQuímico, funcionario del CONICET desde 1971, con diferentes cargos, actualmente jubilado. Informa sobre todas las disciplinas según ha conocido los casos por sus funciones, el período abarca especialmente los quince años en que fue Jefe del Departamento de Institutos. Señala conocimiento personal de trece casos de argentinos emigrados, todos los cuales tienen o tuvieron relevante actuación en centros extranjeros, 12 varones y 1 mujer, 5 físicos, 2 matemáticos, 1 ingeniero, 1 ingeniero químico, 1 geólogo, 1 médico. Los lugares de inserción extranjera fueron : Estados Unidos (11) e Italia (2). De los once llegados a EEUU uno se radicó posteriormente en Canadá, otro regresó a Argentina (el único de los trece), 2 se desempeñan en la esfera privada aplicando sus conocimientos científicos, uno está en OEA y los demás en Universidades.

Rodolfo Casamiquela. Paleontólogo y antropólogo, investigador del CONICET, Director del Centro Nacional Patagónico. Informa especialmente sobre científicos emigrados que no regresaron, vinculados a su especialidad y por recuerdo personal. Da una nómina de 10 investigadores : 1 médico, 2 biólogos, 1 palinólogo, 1 botánico, 2 geólogos, 2 antropólogos y 1 paleontólogo, 8 hombres y 2 mujeres. Los lugares de emigración fueron Brasil, España, Francia y Estados Unidos. Algunos tienen relevante actuación en CNRS y NASA. Causas de alejamiento : políticas (pérdida de trabajo, razones morales) : 5, profesionales : 2, insatisfacción con el país en general : 2, no sabe : 1. Los emigrados por causas políticas (reales o presuntas) que conoció (década del 70) regresaron en 1984. Estima que de CONICET se retiraron por esta causa en 1976-77 unos 120 agentes.

Patricio Garrahan. Biólogo, Director del Departamento de Química Biológica del CONICET. Miembro de la Comisión de la Fundación Antorchas para subsidios de repatriación.
Informa desde 1970 sobre el Departamento. Casi todos sus doctorados se han ido : 5 en el grupo inmediato suyo de trabajo y en el resto más. Estima que esas emigraciones son un pérdida muy importante. Ninguno regresó. Conoce otros casos, a título personal, en que el regreso fue traumático : casos de cesantes en 1966, regrasados y vueltos a cesantear en 1976 ; emigrados que regresaron ante promesas que no se cumplieron, etc.

Emanuel Levin. Bioquímico, investigador del CONICET, fundador y Secretario de la primera Comisión Directiva de AADICYT (Asociación Argentina de Investigadores Científicos y Tecnológicos).
Informa sobre diversas disciplinas, por conocimiento personal y por la Asociación para el período 1974-1994. Conoce 20 científicos que han emigrado, 5 becarios y el resto formados, en su mayoría pertenecientes a la vez a CONICET y Universidad de Buenos Aires, en las áreas de ciencias biológicas, médicas y físicas. No le consta que hayan regresado, aún cuando pudieron tener conocimiento de las medidas de repatriación.

José A. Monterroso. Funcionario jubilado de CONCET, en donde trabajó unos 30 años, retirándose en 1992. Ejerció diversos cargos, el último de los cuales fue de Asesor del Directorio.
Informa sobre el período 1962- 1983. Los datos que proporciona, que están tomados de documentación que manejó en la institución, figuran en el texto.

Horacio Rimoldi. Médico especialista en psicología matemática, académico de Medicina y Educación. Director del CIIPME (Centro Interdisciplinar de Investigaciones en Psicología Matemática y Experimental) Informa por propio conocimiento desde 1945 en la Universidad y luego en CONICET, siendo él mismo un emigrado que retornó. Conoce 23 casos de argentinos de alta calificación en diversas disciplinas que se radicaron en el exterior, de los cuales sólo dos regresaron, uno de ellos, el Dr. De Robertis, muy al final de su carrera.

Liliana Sacco. Profesora. Jefa del Departamento de Becas Externas de CONICET, con diez años de experiencia en el área. Informa sobre becarios externos en el período 1985-1995. En este período y para becarios las causas de alejamiento determinante son profesionales y hacen picos coincidiendo con los períodos de retracción en el ingreso a Carrera de Investigador del CONICET.

Tito Suter. Físico, investigador jubilado de CONEA y actualmente director de CAICYT, Centro de Información Científica y Tecnología de la Secretaría de Ciencia y Técnica de la Nación Informa sobre CONEA en los períodos de los presidentes militares (Contralmirantes Quihillalt y Castro Madero). Señala que CONEA en esos períodos no tuvo problemas de rivalidades internas profesionales porque los militares que la dirigían eran ajenos a ellos y tenían sus propios criterios para conducirla, seleccionar su personal y aprobar proyectos, inversiones y formación calificada en el exterior. Con respecto a la ley de prescindibilidad, las nóminas de los cesanteados llegaban de las esferas políticas superiores. En cuanto a detenciones (y posteriores desapariciones) algunas sucedieron en el mismo lugar de trabajo, pero el personal que las efectuó era ajeno a CONEA. Le consta que el propio Castro Madero gestionó la libertad de varios detenidos, en algún caso con éxito, pero sus propios superiores militares lo desoían.

[1] Se aplicó durante el Proceso Militar (1976-1982). Fue una disposición dictada por la Junta Militar que permitía prescindir de un agente sin sumario previo y que limitó las funciones sobre todo de agentes políticamente contrarios (aunque se ha denunciado que hubo un significativo porcentaje de cesantías por cuestiones personales ajenas a la política, que oscilaría entre un 10 y un 20 %). Sobre los reales efectos de esta disposición hay mucha controversia. Faltan cifras fehacientes porque no parece que las instituciones hayan conservado registros confiables. Las listas que en su momento se manejaron para CONICET según testimonia Levin, se hicieron por infomes orales y resulta poco confiables.

[2] Rimoldi señala que sobre 15 miembros del Directorio actual de CONICET, 10 son médicos o biólogos, lo que significa un exceso de representación de esta rama en relación a sus agentes efectivos de plantilla. Situaciones como ésta no favorecen la multidisciplinariedad que es esencial a un organismo como CONICET, y que ahora en su Directorio no tiene ningún físico, ni astrónomo, ni sociólogo, ni psicólogo, ni especialista en educación, ni un matemático y sólo un historiador para representar a todo el amplio campo de las Ciencias Sociales. En el cambio total de autoridades y evaluadores producido en 1984, la formación de los cuadros dependía más de la filiación política que del área de trabajo y varias líneas de trabajo quedaron sin representación.

[3] Por ej. Garrahan señala que uno de sus presidentes (en 1995), el Dr. Víctor Penchasedeh, genetista, trabajó en la identificación de hijos de desaparecidos que habían sido entregados a terceros.

Scientists Migration in Chile, 1973-1990

Manuel Jiménez

Characteristically, the Latin American University system has been eminently professional. For centuries universities did not concentrate on academic matters, such as scientific research and pure sciences. Academic degrees started becoming important after the 1950's.

The research done in Chilean universities strongly resembles the situation stated above, academic degrees were not based on a body of scientific research. Instead, there was a small professional corps with a strong interest and love for research, which motivated their academic life. A great number of these researchers were liberal professionals, working in their professional field even when not devoting a great deal of time to it. During this period, scientists' migration was a minor problem, not worthy of debate or concern.

Only in the last decades of this century have academic degrees started becoming important, and education at this level developed. Research became a form of quasi-autonomous work in the universities. The trendsetters in Chile were the faculties or institutes of hard sciences. In these institutes, especially at the best known universities, almost every member of the academic staff has a master of sciences, and there are plenty of Ph.D.'s. In the social sciences this trend took longer to catch on. Nonetheless, lately it has become prevalent at Chilean universities. It is important to stress that this is characteristic of the universities, since state and private enterprise have not developed a research culture yet. Therefore, the universities are practically the only employers of Chilean scientists.

Doubtless, the academic career path in which research provides prestige and better salaries has matured in Chile. Researcher training abroad broadened their horizons and provided them with contacts and an interest in keeping up these contacts. At this point, scientists' migration appeared on the scene as a real and worrisome problem for the underdeveloped world.

Within the Latin American tradition, in which official papers, contracts, and laws are deeply respected, one means of stopping brain drain was to create legal mechanisms and to include these provisions in work contracts. For this reason we devote a great deal of time and work to this matter in this paper.

The most important law to promote researcher education was the Decreto con Fuerza de Ley No. 22 (Decree with legal enforcement) in 1981, which established a massive scholarship program. In its provisions, it set forth the state's duty to contribute to the development of universities by training high level professionals. The added emphasis indicates the still dominant idea of professionalism related to Latin American universities.

The Chilean Government established an important project to facilitate postgraduate education abroad for highly qualified personnel (from universities, professional institutes, and public services). To be eligible, students had to apply, at the latest, two years after graduation. After terminating their postgraduate studies abroad, the beneficiaries of this program were required to accept a position at a Chilean university, professional institute or in the public services.

Professionals already working in the higher education system (universities or professional institutes) could apply for a grant up to five years after graduation. The selection process was the responsibility of state ministers and a council.

The importance of this project can be seen by the number of grants provided, from 1981 until 1995 there were 807 grants. The postgraduate education programs attended showed a clear

preference for the fields of : economic and administrative sciences, social sciences, law, health, engineering, pure sciences and education & culture. During the last six years (1990-1995), grants for Ph.D.'s rose to 51 %, M.S.'s. to 30 %, and diplomas for professional expertise to 19 %.

A large number of Ph.D. candidates needed to hold a job to supplement their income. The main reason being that most Ph.D.'s required at least four years of education and the government grants were given for only three years. Therefore the students had to earn some money to cover the difference between their salaries and the cost of living in developed countries.

The amount of the Chilean government's investment was US $31,600,000 to this time. This was a yearly average of over two million dollars. On top of this investment were the grant holders' salaries which were paid by the university or public services employers. Normally, 50 % of the grant holders studied in the U.S. This percentage decreased during the last five years, and Spain, England, and France took on greater importance. From 1990 to 1995, university personnel received 60 % of the grants and public services employees received the remaining 40 %.

The grants provided by this law were quite generous, which is exceptional for Chile. They covered tuition expenses and university administrative charges, an annual sum of US $300 towards paying for books, and round-trip air tickets for the student and his family. As well, the family received US $300 per year for health insurance. When the program began, the grant provided a monthly allowance of US $500 plus $150 for the spouse and $80 per child.

Very soon thereafter these allowances were increased by Law No. 18,681 to US $700 or $820 monthly. The latter sum was applied when the student's employer was not providing any salary, and the insurance allowance was raised to $700. The total number of grants awarded rose from 400 to 1400.

The considerable amount of money invested by the Chilean Government in this program was to be protected in different ways : (1) The grantees were required to return to Chile after receiving their degrees in order to work for their universities or state offices for a period of time, at least twice the amount of time spent abroad. (2) The Council had the right to require the grantee to sign a contract related to duties and additional guarantees, beyond the ones set forth by the law. The contract would guarantee that the graduate's expertise would be at the service of the state, the university or the professional institute for a compulsory period of time.

Control over all student benefits and their guarantees was in the hands of the Oficina de Planificación Nacional (National Planning Office). If a student did not comply with the duties and obligations set out in the contract, the debt would have to be repaid immediately by the student or his guarantor. The National Defense Council of the State, according to a report produced by the Ministerio de Planificación Nacional (National Planning Ministry, MIDEPLAN), could agree to special payment arrangements only in exceptional situations or for cases due to unavoidable circumstances. It was the responsibility of the National Defense Council to protect the state's investment, even when this meant going further than the provisions under the law. Any new debt agreement between the parties would protect the state against inflation and from paying interest (Ley 19,155, Hacienda 1992).

The grant's systematic legal regulations, reflect the duties of the grant holders and the regulations designed to dissuade succumbing to the temptation to stay abroad after receiving a degree. The purpose of these regulations to avoid grant holder migration is evident, the attraction of staying in highly developed countries, for both economic and scientific gains, is well known.

The cost to the government for grant holder desertion could represent a significant amount of money, university tuition alone abroad can easily reach over US $40,000, plus living expenses, salaries, and air tickets totaling over US $100,000 per person. This does not count the cost of

education from primary school to university in Chile. Failure to return to Chile would mean the repayment of that amount of money in cash up-front. Otherwise, an arrangement could be negotiated to make payments in installments, adding on inflation and interest.

To avoid any risk, MIDEPLAN required the grant holder to provide a guarantor, who would be responsible for repayment, in accordance with a signed contract, of the money expended by the grant holder in case of failure to fulfill his duties as student or failure to come back to Chile after receiving a degree abroad.

Universities, in turn, employed similar legal devices to protect their investment in the grant holder. Their investment was by means of continuing to keep the student on salary and maintaining seniority. University regulations were sometimes more stringent than the government ones. With slight differences between universities, professional institutes and the public service, these conditions were : 1. Written authorization to apply for a grant ; 2. The signing of an agreement that included the commitments : (a) to return to a job once the post graduate courses were finished and the degree was awarded, (b) to work in this job for a period of time at least equal to the duration of the grant, plus one year, to a maximum of five years. 3. To guarantee the above by means of an insurance policy called a " Seguro de Fidelidad Funcionaria " (Employee Loyalty Insurance), which is a compulsory guarantee for the amount of money paid by the university to the grant holder.

This series of legal guarantees, in accordance with our traditions, left out some important regulations which would favor postgraduates once they returned to Chile. Among them improved career advancement opportunities in the academic realm, and a pay increase in accordance with the training's importance. The provision of scientific equipment and materials that would assist the returning graduate's work in the field of research was not considered. In too many cases, the support planned by the university or public service was not clearly defined. Most of the time, the initiative was in the hands of the returning graduates and not the institution. Often, the graduate would be the only expert in his field, and would be isolated at the local level. His only contact with other experts was through a network of experts in foreign countries. Later, these contacts would become one of the graduate's motives for migration.

The military government was strongly criticized by researchers at the national and international levels for firing scholars and researchers. A survey printed in Mensaje, a publication of the Catholic Church and a strong critic of the military government, shed some light on this problem. According to Mensaje, the main reasons for resigning from academic positions were economic rather than political. Economic reasons accounted for 59 % of resignations among engineers versus 14 % which were attributed to political motives ; in pure sciences 44.7 % cited economic problems versus 6.9 % who mentioned political ones ; in medicine 45.5 % versus 9 % ; in agriculture 58 % blamed economic problems and none gave political reasons.

The social sciences had the highest percentage giving political reasons for resignation. In this field 50 % cited economic reasons versus 21.4 % that mentioned political factors. As a complement to this data, 66.6 % of the researchers fired from universities continued to work in Chile versus 33.4 % who found jobs abroad (Real, 1975, 380-1).

Chile's administrative structural and financial problems, and the economic transformations implemented under Pinochet's government, had deep repercussions on the scientific community. There was a consensus that scientific research was extremely important for national development. As well, university budget cuts had a deep impact on their quasi-monopoly on scientific research (Brunner, 1986, 125).

The new scenario included : (a) harsh competition for national and international funding ; (b) competition for research contracts between public and private services ; (c) severe cutbacks to state funding. These elements produced uncertainty in the research field and made its development more difficult (Lavados, 1987, 25 ff).

Funding cutbacks were evident in Chilean universities, they were 47 % in 1973, 37 % in 1974,

intensified to 57 % in 1980, and then decreased 32.5 %. These ups and downs explain the findings of the survey previously cited. Chilean scientists were not used to competing for funding. Worst of all, they refused to do it because it went against their academic culture.

Despite all these ups and downs, in the long term they produced a favorable side, inspiring improvements in the use of scarce resources, and increasing investments in some universities (Hachette, 1990, 229). There is no doubt that over time competition between research groups has become part of research culture, every day criticism of competition is milder and it is becoming accepted.

It is notable that one segment of scientific researchers, the social sciences, matured, and migration was less than expected. This phenomenon was due to the appearance of a number of research groups created outside the universities, funded by international agencies or private institutions (Sanders, 1981,14). Most of these groups shared a characteristic, they were in political opposition to Pinochet's government. These groups widely disseminated their criticism, both on political and scientific matters.

Their research work permitted them to accumulate considerable amounts of money, not only for research itself but for researchers' salaries. This motivated the creation of a number of research institutions that hired most scholars fired from their positions in universities. In this way their migration was avoided. It is hard to calculate the amount of funding provided by external sources, a rough estimate is seven million dollars yearly, for social research alone. This amount of money is greater than the sum of the universities and public offices budgets for social research.

Migration of young scientists never reached high numbers because of the legal restrictions. There was an agreement between the government and foreign institutions, that offered grants to Chilean students, in order to discourage the students from staying abroad after receiving a degree.

Nonetheless, an important factor in the migration of young scientists were the benefits provided to those whose parents or grandparents had migrated from Europe. Many of them had dual nationality (German, British, French, and others). This gave them citizens' rights in the countries where they were studying. In spite of this, all of these countries mildly encouraged the graduates return to their native country.

In this sense Germany played a very important role. Since 1951, the government, the Humboldt Foundation, and other German institutions have provided nearly twenty grants yearly for Chilean-German citizens. Most of them go to second or third generation Chileans. There has been no follow up of these graduates. Therefore, it is impossible to know how many of them stayed abroad permanently or came back to Chile. Finally, it is unknown how many of them emigrated with no intention to return.

Scientists' migration through personal contacts, their records as researchers, or their published papers, have always played key roles in the decision to migrate. This is especially evident in relationships forged through friendship and collaboration while the colleagues were working on their postgraduate studies. The ability to create everlasting bonds based on shared interests in the scientific community is well known.

The increasing number of papers published by Chilean researchers in international journals awakened the interest of groups of researchers and resulted in invitations for them to collaborate with important institutions. Many of these invitations were addressed to young and promisory scientists. Sometimes, they were not happy with their salaries and the prospects for scientific development in Chile. Unfulfilled expectations or difficulties to attain them, motivate scientists to migrate. This element, though qualitatively important, is not equally significant from a quantitative standpoint, given the limited number of world class scientists in Chile it is not so difficult to have a great influence in a given field.

The legal guarantees designed to avoid scientists' migration have been successful with govern-

ment grant holders. Despite the fact that there was no a systematic follow up, MIDEPLAN recognized that the estimated losses were few and most of the students returned to Chile shortly after graduation.

No consistent follow up has been done on researchers who obtained grants as individuals or on grant holders who have dual nationality. There is a well founded suspicion that the latter have the best chance of staying on in the countries in which they graduated, enjoying all the advantages of dual nationality, included the existing social benefits.

The Chilean Academy of Sciences has some studies on migration, unfortunately only in the pure sciences. Their conclusions are : (a) in the case of young and well educated biologists, the decision to return depends on government policy decisions (Academia Chilena de Ciencias, 1993, 64) ; (b) 95 % of the Chilean scientific community living abroad would like to re-establish scientific links with Chile, even when only 50 % would like to return to the country (ibid. 79) ; (c) The majority of those who received their Ph.D.'s in Chile present a tendency to stay in the country. Of a grand total of 116 Ph.D.'s in biology, 24 are abroad. Of 100 chemistry Ph.D.'s only 7 are abroad, most of the graduates are working at Chilean universities and national research institutions (ibid. 252).

Finally, it is necessary to state that we have not addressed the problem of scientists educated abroad without government support, through programs created for people who migrated for political reasons. This phenomenon, being of great importance, deserves exhaustive research which is yet to be done.

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La emigración de científicos en Chile : 1973-1990

Manuel Jiménez

En el contexto de América Hispana, el sistema universitario se ha caracterizado por ser eminentemente profesionalizante. Las universidades por muchas décadas descuidaron la formación estrictamente académica y hasta mediados de este siglo los grados académicos, cualquiera que fuera su nivel, eran casi inexistentes.

Una situación similar se presentaba con la investigación universitaria, no existía un cuerpo de investigadores con grados académicos. Lo que si existía era un cuerpo de profesionales que sentían un profundo interés y amor por la investigación, haciendo de ella una parte importante de su vida académica. Numerosos entre ellos eran profesionales que ejercían su especialidad en forma liberal aunque en forma voluntariamente restringida. Durante este período la emigración de científicos fue un problema menor y no era objeto de debates ni de preocupación real. Lo mismo se puede afirmar con relación a las empresas del Estado, las que sólo recientemente han incrementado el número de postgraduados entre sus funcionarios.

Sólo en las últimas décadas empiezan a adquirir importancia los grados académicos y la investigación como una forma de trabajo cuasi-autónoma. Los iniciadores de esta corriente en Chile, fueron indudablemente, las facultades o institutos de ciencias básicas. En ellas, especialmente en las universidades más importantes, casi la totalidad de sus cuadros académicos tiene por lo menos un Magister y son mayoría los doctores. En el área de las Ciencias Sociales esta tendencia partió con retraso, sin embargo ha cobrado enorme fuerza dentro de las universidades chilenas.

Es importante señalar que este problema afecta prioritariamente a las universidades, las empresas privadas no han desarrollado una cultura de investigación y por ende no son una fuente laboral de importancia para los científicos chilenos.

Indudablemente el despertar de una carrera académica, en que la investigación prestigia y mejora las remuneraciones, la formación de investigadores en el extranjero ha abierto horizontes y creado contactos. Al mismo tiempo ha aparecido el interés por conservarlos en los paises en los cuales se formaron. Aparece de este modo el fenómeno de la emigración científica, como un problema real y preocupante.

Dentro de la tradición hispanoamericana el papel sellado, los contratos y las leyes son enormementes respetados, una de las vías para detener esta pérdida de personal altamente calificado ha sido desincentivarla por medio de leyes y garantías contractuales. Por esta razón le asignamos un gran espacio y dedicación en este trabajo a estos mecanismos utilizados destinados a impedir la pérdida de recursos humanos altamente calificados.

La primera y más importante ley para incentivar la formación de investigadores fue el Decreto con Fuerza de Ley Nº 22 de 1981 que crea un masivo programa de becas. Su fundamentación señalaba que el Estado tenía la obligación de contribuir al perfeccionamiento de las universidades mediante la formación de profesionales de alto nivel. El subrayado enfatiza el predominio, aún existente, de una idea profesionalizante con relación a las universidades y la investigación (Diario Oficial Nº 30.942).

Por lo tanto el Gobierno creó un amplio plan de desarrollo de recursos humanos que permitió el perfeccionamiento en el extranjero de numerosos egresados de las Universidades e

Institutos profesionales de Chile durante los dos años siguientes a su egreso, debiendo tomar un puesto al servicio de una Universidad, Instituto profesional o empresa del Estado al término de su beca.

Los profesionales o académicos que, en el momento de postular, estuvieran trabajando en una universidad o un servicio público de la administración centralizada o descentralizado del Estado podían hacerlo hasta cinco años después de su graduación o recibir su título profesional. El proceso de selección estaba bajo la responsabilidad de varios ministros y de un cuerpo técnico.

La magnitud de este plan es evidente por las cantidades de becarios agraciados a partir de 1981 y hasta 1995, la que alcanza la cifra de 807 becarios. Los campos de estudio presentan un claro predominio de las ciencias económicas y administrativas, ciencias sociales y derecho, salud, ingeniería, ciencias básicas y educación y cultura. En los últimos seis años (1990-1995) las becas para doctorado han alcanzado un 51 %, las de Master un 30 % y las de especialización un 19 % (Agencia de Cooperación Internacional, 1996). Esto significa que una cantidad importante de doctorados han debido complementar sus ingresos en los paises donde estudian vía ayudantías o trabajos pagados. Al ser normal que la obtención de un doctorado tome un mínimo de cuatro años y las becas de MIDEPLAN son por sólo tres, los becarios deben trabajar para cubrir la diferencia entre el sueldo que perciben de sus universidades o reparticiones públicas y el costo de la vida en los paises desarrollados en su último año del doctorado.

Los montos invertidos han alcanzado aproximadamente la suma de U. S $31.600.000, con un promedio anual superior a U.S. $ 2.000.000. De estos becarios aproximadamente un 50 % van a estudiar a U.S. Esta cantidad ha disminuido en los últimos cinco años y han aumentado considerablemente como destinos España, Inglaterra y Francia. Desde 1990 a 1995 el sector académico ha ocupado aproximadamente un 60 % de las plazas ofrecidas y el sector público el porcentaje restante (Ibidem).

Las condiciones de las becas de este Decreto con Fuerza de Ley era bastante excepcional para el medio pues cubrían los gastos de matrícula, tuición y derechos en las universidades de destino, elegidas libremente por los becarios, cualquiera que fuera su costo. Una asignación de libros de USA $300 anuales, pasajes de ida y vuelta para el becario y su familia, USA $300 anuales para cubrir primas de seguro por enfermedad del agraciado y su grupo familiar. La beca contemplaba a dicha fecha un subsidio mensual de USA $500, más $150 por la esposa y $80 por cada hijo.

Muy pronto estas cantidades fueron aumentadas, de acuerdo a la ley 18.681 de 1987, significativamente a USA $700 y a 820 mensuales en el caso de que no recibiera sueldo de su empleador y la asignación para prima de seguro subió asimismo a USA $700 anuales y se aumentó asimismo la cantidad total de becas a otorgar a 1.400 (ley 18.681).

Esta cuantiosa inversión debía ser cautelada y los agraciados debían contraer, como mínimo, la obligación de regresar al país una vez concluidos los estudios para integrarse a las universidades o servicios públicos patrocinantes por un período al menos el doble del tiempo de permanencia en el exterior. El Consejo podía estipular, en forma de un contrato con los becarios, obligaciones y cauciones adicionales a las previstas en la ley que aseguraran que el becario aportaría al Estado, institutos profesionales o universidades los conocimientos y experiencias que adquirieran en el transcurso de la beca por un tiempo prudencial.

El control de todos los beneficios y garantías quedó en manos de la Oficina de Planificación Nacional. En el caso de incumplimiento de las obligaciones asumidas por los becarios o fiadores solidarios, sería el Consejo de Defensa del Estado, previo informe favorable del Ministerio de Planificación y Cooperación, quien podría acordar con el deudor y sólo en los casos fortuito o de fuerza mayor, la modificación de las obligaciones asumidas. Celebrando los acuerdos que se estimaran convenientes para resguardar los intereses fiscales, pudiendo para esos efectos producir acomodaciones en relación con los artículos pertinentes. Las nuevas obligaciones que se

pactaran en dinero, deberían incluir cláusulas que protegieran al Fisco de la devaluación monetaria y aumentada con los intereses correspondientes (Ley 19.155, Hacienda 1992).

De las leyes que regulan este sistema de becas, el más importantes del país, se desprenden las condiciones a cumplir por los becarios y las severas regulaciones diseñadas para evitar que ellos pudieran sentirse tentados a permanecer en el extranjero después de obtener los grados académicos. La intencionalidad evidente de estas regulaciones era evitar la migración de los becarios que pudieran verse tentados a permanecer en centros de alto desarrollo en el extranjero, tanto por factores económicos como por razones académicas. El costo para el Estado y los patrocinantes, de la permanencia de los becarios en el extranjero, podía llegar a sumas muy considerables y cercanas o superiores a los USA $100.000, per capita. La devolución en caso de incumplimiento debían ser pagadas prácticamente al contado y si lo eran en forma pactada, en un lapso prolongado de tiempo, debía agregársele los intereses de este capital. Para estos efectos MIDEPLAN exige como requisito la existencia de un codeudor solidario quien se hiciera responsable mediante escritura notarial de responder por los fondos percibidos por el becario en el supuesto caso de incumplimiento de los requisitos de la beca.

Las universidades que patrocinaban a sus académicos debieron tomar medidas similares para cubrir el pago de sueldos durante los años de estudio. Para este efecto, en términos generales, adoptaron una serie de medidas las que seguían, muy de cerca, las disposiciones legales vigentes, e incluso haciendo las condiciones aún más severas. Con ligeras variantes las condiciones a los becarios incluyen :

1. Un permiso de la universidad o del empleador para postular a beca ;
2. Suscribir un Convenio de Beca que incluye : a) reincorporarse a la Universidad al término de la Beca, y, b) trabajar en ella por un período mínimo equivalente a la duración de la Beca más un año, con un máximo de cinco años ;
3. Garantizar el cumplimiento de lo anterior mediante un Seguro de Fidelidad Funcionaria, garantía de carácter insistituible y que garantizaba la devolución de las remuneraciones pagadas por la institución patrocinante.

Las oficinas o reparticiones estatales seguían un patrón similar de suscripción de garantías, sin existir marcadas diferencias.

Esta trama de garantías legales si bien se insertaba plenamente dentro de nuestras tradiciones, no contemplaba algunos aspectos importantes que incentivaran la permanencia en Chile de los postgraduados más brillantes. Entre otras la inexistencia de una carrera académica bien definida y de acuerdo con ella una escala de rentas razonables para los académicos en general y especialmente para los graduados en el extranjero. No se consideraba igualmente la implementación de equipos y materiales que permitieran al graduado seguir su avance dentro de su campo de especialidad. En numerosas situaciones el plan de desarrollo de las universidades e instituciones patrocinantes no estaban claramente definidas y la iniciativa correspondía única y exclusivamente al postulante. A su vuelta, sucede con frecuencia que el único especialista en su materia era él. Por esta razón quedaba aislado, por lo menos a nivel local, puesto que podía seguir comunicado con una red de especialistas en el extranjero. Estos vínculos se convierten en una de las fuentes promotoras de la emigración.

Aún cuando las acusaciones en contra del Gobierno Militar por el despido de académicos e investigadores tanto en la educación superior como en las empresas del Estado fueron numerosas, por diversos autores a nivel nacional e internacional, una encuesta de la Revista « Mensaje » perteneciente a la Iglesia Católica y fuertemente crítica a este gobierno, publicó una trabajo relacionado con este tema. En ella se demuestra que la razón más importante de las renuncias eran de índole económicas mas que políticas. Los problemas económicos explicaban el 59 % de la migración de ingenieros y tecnólogos contra un 14,7 % que explicaba este problema como político ; en ciencias un 44,7 % contra un 6.9 ; medicina 45,5 % contra un 9 % ; agricultura 58 % y nadie argumentó razones políticas.

En el campo de las ciencias sociales se presentaron los más altos porcentajes que culpaban a los problemas políticos como la mayor causa de migración de científicos y académicos, esta ascendía a un 21,4 contra un 50 % que culpaban a los problemas económicos.

Como complemento a esta situación aparecía el hecho que un 66,6 % de los investigadores despedidos permaneció en Chile y un 33,4 % encontró trabajo en el extranjero (Real, 1975, 380-1).

Los problemas de financiamiento y las transformaciones de la estructura económica de Chile desarrolladas por el régimen de Pinochet afectaron profundamente la comunidad científica. Existía consenso de que la investigación científica era esencial para el desarrollo nacional y que las reducciones del financiamiento universitario habían afectado su cuasi-monopolio de la investigación científica (Brunner, 1986, 125).

El nuevo escenario incluía a) competencia por los fondos a nivel nacional e internacional ; b) contratos de investigación públicos y privados ; fuerte disminución de fondos a los organismos del Estado. Estos elementos produjeron incertidumbre en el desarrollo de la investigación y su funcionamiento (Lavados, 1987, 25 y sgtes.).

La disminución evidente de los fondos de investigación de las universidades chilenas en un 47 % en 1973, en un 37 % en 1974, recuperándose hacia 1980 año en que alcanza un 57 % y luego una nueva declinación que lo llevó a un 32,5 % de los fondos nacionales de investigación. Estas alzas y bajas explican los resultados de la encuesta antes citados, los científicos chilenos no estaban acostumbrados a la competencia por recibir fondos, más aún la rechazaban por no ser parte integral de su cultura.

A pesar de estos vaivenes los resultados en el largo plazo fueron positivos en la mejoría y en la utilización de recursos escasos, incrementándose la inversión en investigación en algunas universidades (Hachette, 1990, 229). Es indudable que con el correr de los años la competitividad entre equipos de investigación ha empezado a formar parte de una nueva cultura de los investigadores y cada día son menores las críticas a la competencia que empieza a ser universalmente aceptada.

Curiosamente en el ámbito de la investigación científica en el campo de las ciencias sociales, la migración fue menor gracias a la aparición de numerosas instituciones privadas de investigación las que se convirtieron en una importante fuente de trabajo para los investigadores marginados de las universidades gracias a los generosos aportes exteriores para financiarlos (Sanders, 1981, 14). La mayor parte de estos grupos estaban íntimamente ligados a la oposición política al gobierno de Pinochet. Estos grupos difundieron ampliamente sus críticas tanto en el plano político como en el científico.

Evidentemente, es difícil calcular con exactitud los montos recibidos por estas instituciones, se estima que ascendían a unos siete millones de dólares anuales, solamente para investigación social, un monto jamás alcanzado por la suma de las universidades chilenas y los organismos del Estado.

La migración de científicos jovenes no adquirió grandes niveles debido, en gran medida, a las regulaciones legales y al acuerdo del gobierno con numerosos oferentes de becas (gobiernos e instituciones privadas) de no incentivar la permanencia de los becarios en los paises en que estudiaban una vez obtenido el grado.

Otra fuente importante de migración de científicos jovenes correspondió a los descendientes de inmigrantes europeos cuyos hijos o nietos poseían doble nacionalidad (alemanes, ingleses, franceses u otros). Por este hecho podían estudiar en los paises de sus ancestros, gozando la totalidad de las ventajas del ciudadano del país en cuestión y sin restricciones. Sin perjuicio de lo anterior dichos paises incentivaban el retorno de estos científicos a su país de origen una vez finalizados sus estudios.

En este campo Alemania ocupa un rol preponderante, a partir de 1951 el gobierno, la Fundación Humboldt y otras instituciones de esa nación han becado un promedio de veinte

chilenos anuales, en su gran mayoría descendientes de segunda y tercera generación de alemanes para continuar estudios de postgrado. No existe un seguimiento de estos becarios y por ende es imposible saber cuantos de ellos han permanecido en el extranjero en forma permanente, cuantos han vuelto y permanecido en Chile y cuantos, finalmente, han emigrado sin perspectiva de retorno.

La migración de académicos vía contactos personales o de su record como investigador, reconocidos a través de las publicaciones de su especialidad siempre ha sido un elemento importante en la migración de científicos. Otro factor importante son los vínculos de amistad y colaboración creados mientras cursaban sus estudios de doctorado, es bien sabido que la comunidad de interés científico es capaz de crear fuertes vínculos. La creciente cantidad de artículos publicados por investigadores de las universidades chilenas en revistas de nivel internacional ha provocado, en ocasiones, invitaciones a colaborar en centros científicos importantes a investigadores promisorios quienes, en numerosas oportunidades se encuentran insatisfechos de los niveles de sueldos de las universidades y de sus perspectivas de desarrollo como científicos. Estas espectativas insatisfechas o difíciles de satisfacer ayudan a tomar la decisión de emigrar. Este factor siendo cualitativamente importante, no es igualmente significativo en lo cuantitativo, pues nuestra cantidad de científicos de exportación no es tan alta como para influir decisivamente en este campo.

Por otra parte las condiciones legales diseñadas para evitar la migración de científicos han logrado un éxito notable. MIDEPLAN que controla el sistema de becas creado por el gobierno reconoce que, a pesar de no existir seguimientos sistemáticos de los becarios, las pérdidas son mas bien escasas y la mayor parte de ellos vuelve al poco tiempo después de haberse graduado.

No existen seguimientos sistemáticos con respecto a los que han conseguido becas en forma independiente o a los becarios que gozan de doble nacionalidad. Existe la sospecha fundada que estos últimos gozan de ventajas comparativas que les permiten quedarse en el país que han cursado sus estudios, utilizando para ello las ventajas de su doble nacionalidad, incluyendo el gozo de todos los beneficios sociales existentes.

Conclusiones

Se desprende de esta ponencia la inexistencia de estudios actualizados sobre la migración de científicos chilenos. La bibliografía de los años setenta y anteriores se basaba única y exclusivamente en la fuga de cerebros y se basaban primordialmente en las teorías de la dependencia, en las cuales subyacía la idea de la existencia de complots de las metropolis para extraer otra riqueza más de la periferia. Es evidente la urgencia de estudiar este fenómeno desde una perspectiva de mayor actualidad, afirmada en hechos económicos, avance científico, políticas salariales y status de los académicos nacionales.

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Scientific Migration in Russia in the early 1990's: Scale, Structure and Consequences

Galina Kitova

For many decades the number of R & D personnel in the former USSR and, particularly, in Russia constantly increased. Though in the late of 1980s the rate of increase reduced perceptibly and in the early of 90s the reduction of R & D personnel in Russia became absolute, the approaches to analyzing this process remained practically unchanged until 1992. The substance of this analyses came down to the calculation of indicators for R & D personnel dynamics.

The radical economic and political reforms in Russia in the early of 90s were conducted under conditions of global social and economic crisis. This crisis deeply affected the R & D sphere and sharply changed the traditional mechanisms and tendencies of the R & D personnel reproduction. In 1992-1993, when the number of national R & D personnel in Russia dropped by 23 %, rigid dependence of the scope and structure of this indicator (number of R & D personnel) on parameters of the personnel mobility (especially on the parameters of outflow of the personnel from R & D sphere) became obvious.

As a result Russian and foreign analysts began to investigate processes of R & D personnel mobility in Russia. They started from the problem of the emigration of Russian scientists abroad and raised alarm on that aspect. The concentration of the analysts effort on this problem was inadequate to its real scope and importance in Russia. Indeed, according to Russian official statistics, 426 scientists emigrated in 1993 for permanent residence abroad. But total decrease in national R & D personnel during this year was more than 200,000 persons.

In recent years a number of studies on Russian R & D personnel mobility have been conducted, but each of them deals usually only with some aspect of the problem. In most cases their results are incomparable and sometimes contradictory.

The " state of the art » in the field are determined mostly by the lack of aggregate official statistical data that could be used as a direct measure of process of mobility. The only exception is a general survey of R & D personnel mobility conducted in 1992-1993 by State Committee on Statistics (GOSCOMSTAT).

According to the survey the outward flow out of R & D sphere in that period was three times higher than the inward flow into it. That fact shows that both the scale and the structure of labor force in R & D were mainly determined by the peculiarities of the outflow [1].The analysis of this data for 1992-1993 shows that the parameters of the outflow varied greatly as regards different categories of the personnel. Thus, if the number of engineers and constructors in R & D sphere have been reducing about 20 % annually, the number of the managers (heads of the organizations and their departments) dropped about 9 % each year. Naturally such differences in outflow meant the changes in the structure of R & D personnel.

Such a significant decrease of the number of engineers and in some lesser extent the number of technicians and supporting staff in R & D in Russia became the factor that prevented the conducting of experiments and tests, limited their complexity and scale. This, in its turn, led to

the gradual decrease in qualification, necessary skills and experience of those who remained in R & D sphere. The negative consequences of these trends are evident. The increase of the share of R & D managers against the background of significant general decrease of R & D personnel led to the situation when in 1994 some of the departments and even the whole R & D organizations did not have a “ critical mass ” necessary for effective research. There were facts when a department (actually or formally) consisted of only one employee - it’s head. The survey of GOSCOMSTAT exposed also the fact that most of the employees that had left R & D sphere had done it voluntary by their own will. In other words their dismissal was not the decision of managers or the consequence of liquidation or restructuring of their organization. This shows, in particular, that the decrease in the number of R & D personnel in Russian science in the 90s was spontaneous and happened without any purposeful influence of the state.

But certainly the parameters of mobility of R & D personnel were strongly influenced by the external (to the R & D sphere) factors : the general social and economic situation, the relative level of salaries and wages in R & D and other spheres of activity, etc.

Thus, the general survey of mobility in R & D conducted by GOSCOMSTAT made it possible to evaluate the scale and some structural characteristics of the process in 1992-1993 and in spite of the short period of observation to expose some tendencies.

The detailed analysis of R & D mobility in Russia after the 1993 was necessitated by principal non-inertial quality of the social and economic development processes in the country in the 90s, by the gradual and lagged character of the impact of the sharp drop in the number of employees in R & D in 1992-1993 and the further increase of the symptoms of it’s crisis. As there was almost no official information on the subject after 1993 the only possible way to get the data was the sample survey of R & D organizations

The survey was conducted in six regions of Russia. Two of them were the “ metropolitan ” regions of Moscow and St.-Petersburg (or the “ center ”) [2] and the others four though very different can be classified as “ periphery ” (Nijegorodskaya oblast, Saratovskaya oblast, Tomskaya oblast and Stavropolsky kray). Such sample enables to evaluate the regional differences of the mobility, to find out, in particular, the discrepancies between the parameters of mobility in the “ center ” and in the “ periphery ”.

The later problem is very important for Russia where there are great historically formed differences between the “ central ” and “ provincial ” science [3].The sample consisted of more than 60 R & D organizations conducting both basic and applied research and development projects in natural and engineering science [4]. For getting the information on mobility the following methods were used : the collection of the statistical quantitative data on each person released or employed during the year ; the questionnaire for the managers of the R & D organizations and interviews with them ; the questionnaire for the state officials responsible for the R & D sector in the regions. The results of the analysis concerned the situation in 1994 and 1995.

Against the background of general reduction of employees in the sample there were a significant variation of that indicator in different organizations. So, rates of decline in the organizations concerned with applied research were higher than the average rate, but in some organization of academic sector conducting the basic research there was even an absolute growth of number of employees (though the increase have not compensated as a rule the reduction of 1992-1993). As that fact have been true for all the 90s it can be looked upon as an indicator of the relative depth of the crisis in different sectors of R & D.

The rate of decrease of personnel during 1992-1995 gradually slowed. In the opinion of R & D managers it can be explained mostly by the fact that almost everybody who could and wished to leave R & D sphere did it in 1992 and 1993. Already in the beginning of 1994 many organizations had exhausted all possible reserves for reduction of personnel. Further decline in the

number of employees created a threat to their existence. The outflow from R & D was also restrained by the general decline in the national economy and of labor market, so chances of finding employment outside the R & D became more slim. A definite role has played the change in manager's attitude to so called secondary employment : R & D managers were strictly against it in the beginning of the nineties, but gradually came to realization the necessity of tolerance towards it and began to look at it as a mean to preserve the personnel of their organization.

The sampling survey showed that the tendency of higher rates of leaving for engineers, technicians and supporting staff that was exposed by the GOSCOMSTAT survey for 1992-1993 was more or less true for 1994-1995 as well. It's negative consequences were also confirmed : in 1994 the managers of R & D organizations (in the first place of a large ones that were leaders in their fields of research) stressed that the lack of experience and qualification of their personnel compelled the organization to abandon some complex and large-scale experiments.

Another negative consequence of sharp decline in R & D labor force was the change in the age structure of employees. The first indications of the growth of average age of researchers became already evident in the end of the 80-ies. The survey showed that the process gained speed in the nineties mostly because of the high share among those who left R & D persons of 31-40 and 41-50 age groups.

It means that the R & D sphere were loosing those who were the main bearers of the knowledge and experience. The opportunities for finding the replacement for that outflow, as showed the interviews with the managers, turned out to be rather rare. Especially it concerned the unique institutions that had no analogs in Russia. But even if it was possible to find the adequate replacement still the data showed that in place of five researchers in the age of 31-40 who had left only one in the same age group was employed. For 41-50 group that ratio was four to one.

The analysis of age distribution of persons who left R & D organizations and those who were newly employed showed that recently a gap between the youngest and eldest age group have begun to form. Even if the situation became more stable a gradual movement of this gap with time will greatly influence the age structure of R & D personnel for several decades.

Though the tendency of loosing researchers of middle age groups is true both for " center " and " periphery " there are significant differences between those two groups of organizations. The average age of newly employed was less than of those who left in both groups but in metropolitan area the difference was 3 year and in province 7 years. A somewhat unexpected result, considering a low salaries in R & D and low prestige of science in general, was a large inflow of persons of less than 25 years old into R & D organizations in the " periphery ". Share that age group averaged 4,5 % of the outflow and almost 30 % of the inflow. It probably could be explained by the large regional differences in the rates and depth of the economic reforms and development. In metropolitan regions 1992-1995 was the period of the rapid growth of a private sector of economy (mostly in trade and banking) that created new working places for young people with wages several times higher than R & D organizations could offer. In most of Russian region opportunities for a young graduates without practical experience to find high-paid work were not very high so employment in R & D was for them the only alternative to unemployment. Thus, the " aging " of Russian R & D personnel in " periphery " is partly restrained by the low level and rates of development of a private sector.

Another grave problem for R & D organizations of " periphery ", especially considering the historically formed gap in the quality of research between metropolitan and provincial science, is high rates (in comparison with the " center ") of outflow from R & D organizations of researchers with doctoral degrees [5]. The main reason probably is that in Moscow and St.-Petersburg the degrees not only guarantee the higher security against loosing the job and relatively higher

salary but also gives larger opportunities for profitable secondary employment. Those factors restrained the outflow of high qualified researchers from metropolitan organizations. In the " periphery " the relatively low number of such specialists enables them to find relatively better jobs outside the R & D sphere, for example in regional governments and commercial organizations that have needs for specialists with degrees.

There are also differences between the " center " and the " periphery " in mobility in some fields of science that have been exposed by the survey. So, the intensity of mobility in R & D organization specialized in medical research was significantly higher than the average. General indicator of mobility (the ratio of a sum of outflow and inflow to a number of employees in the beginning of the year) was for that group of organizations about 50 % and the average indicator was only 19 %. Quite another picture was in mathematical, physical and technical organizations : there the mobility was significantly lower than the average. It's hardly probable that the intensity of mobility by fields of science is reflecting the relative depth of the crisis in them. It's more likely that it depends on the regional peculiarities of labor market. A rapid growth of " insurance medicine " and private medical services that was common for all regions enabled the medical researchers, especially those with medical degrees to find jobs not only better paid but also correlated with their interests and qualification. In other words, even during the general economic crisis the opportunities for medics were better than for mathematicians or specialists in engineering science where the available alternative jobs depends to the greater extent on the situation of the economy.

All these facts let us to formulate a conclusion that the dynamics and parameters of R & D employment in regions, fields of science or sectors are mainly influenced not by the relative level of salaries or general crisis but by the situation on the local labor market. In other words, a lot of people remain in R & D sphere not because they don't wish to leave it but because they have nowhere to go.

We have analyzed the reasons for leaving the R & D jobs using the official standard forms in personnel departments of organizations. According to those standards there could be following reasons of discharge : as one wishes, transfer to another organization, staff reduction or reorganization, retirement, other grounds.

In metropolitan areas 62 % left the organizations with the wording " as one wishes ", in other regions this share was 51 %. As we have already mentioned above such high share shows the unregulated character of R & D personnel reduction. The difference between two groups of regions is also due to the larger number of jobs opportunities in metropolitan regions (first of all in private sector). Those who were dismissed in connection with the transfer to another organization went mostly to state-owned organizations (or example to other R & D organizations). In " periphery " regions the transfer as a ground to dismissal is twice more common than in metropolitan ones. It also confirms the relatively low possibilities for finding job in commercial sector in province.

The number and the share of those who left in connection with staff reduction or reorganization (including it's liquidation) for Russia could be used as indicators of intensity of restructuring processes in R & D sphere. Though these indicators for " center " and " periphery " differ considerably (5.7 % for the first group and 16 % for the second one) both values seem rather low considering the scale of reduction and mean the lack of regulation of the process not only on the state level but also on the level of organizations. So, the main conclusion from the analysis of reasons for outflow from R & D sphere is that as a rule the dismissal was voluntary and people left their jobs because the situation in the sphere was relatively worse in comparison with other sectors of the national economy.

Conclusions and forecast of the mobility

We have mentioned in this paper only some results of the sampling survey of R & D personnel mobility. The survey itself was a part of large-scale research project that was conducted in 1992-1995. Carrying out of the project make it possible to evaluate parameters of the scientific mobility in Russia, to distinguish its internal and external components, to estimate scales of interbranch and territorial elements of the process. To obtain these results we have to work out an approach to complex analysis of R & D personnel mobility in Russia, that has been realized in the project.

The sharp reduction of R & D employment in Russia in the 90s was one of the most evident symptoms of the crisis of R & D sphere. That reduction affected all regions, all fields of science and almost every organization. The dynamics of the process was determined by the external factors and limitations and the decrease in rates in 1994-1995 was due to the deterioration of the labor market in other sectors of the economy. It means that any changes in the economic situation to the better may provoke another " splash " of the mobility and further reduction in number of R & D personnel that could be a grave danger for Russian science.

The only thing that can prevent such a " splash " is a sharp raise in the priority of R & D in national policy. That priority must not be just declarative but should be confirmed by concrete measures and actions that would led to the growth of demand for the R & D services and results both from the state-owned and private enterprises. If the current trends in this sphere continue for two or three years longer it will led to the final and irreversible degradation.

Thus, both the inertial scenario of economic development and the improvement of the situation could mean changes to the worse for R & D organizations. If we consider a major role of the state in financing research in Russia nowadays and a very low expectations for considerable private sources of finance for R & D in the nearest future, it becomes evident that the only way to stop or at least to slow down negative tendencies is to change radically a governmental science policy. It should be admitted that today such hopes are rather unfounded.

[1] A detailed analysis of the results of this survey is published in Russian Economic Studies, N 4, 1995.

[2] Results of the survey for Moscow and St.-Petersburg is published in Russian Economic Studies, N 5, 1995.

[3] The differences were not only a quantitative ones (more than 40 % of total employees in R & D were concentrated in two metropolitan regions) but in many cases concerned the quality of research.

[4] The surveyed organizations conducted research projects in following fields : physics and mathematics, chemistry, biology, geological sciences, technical sciences, agricultural sciences and veterinary, geography, medicine and pharmacology.

[5] The shares of persons with doctoral degrees among those who left their jobs and among newly employed for Moscow and St.-Petersburg organizations were 6 % and 8 % accordingly. For the " periphery " the same indicators were 15 % and 10 %.

International Scientific Migration: 25 years of Latin American Scientific Migration to Europe: France, 1970-1995

Guillermo Lozano

Introduction

The analysis of Latin American scientists migrations in Europe intends to design and establish strategies to identify the scientific and technical potential of Latin American scientists connected to scientific communities in Europe.

This study is oriented to all those who decided to emigrate and remain abroad, enrolled in scientific communities in Europe. It attempts to point out how a scientific and technological potential has been developed and how such a potential can be, within the new international context of development of sciences and technologies, a valuable resource for Latin American scientific communities who seek a better position in the international science scenario.

The problems of International Scientific Migrations are stated today from the globalization of the economy, from the new interpretative contributions of Social Sciences, from the new advances of communication technologies and naturally, from the perspective of the fast expansion of scientific networks throughout the world.

The case of migrations of Latin American scientists in Europe is very illustrative, since it encompasses a rich tradition of cultural cooperation relations, strengthened by the old Latin Americanistic currents that have sought to express in regional policies of cooperation and research.

On the other hand, Latin American policies with respect to the exodus of its scientists present mediocre - when not completely disastrous- results. The so called recovery policies, the return programs, have been generally weakened by a lack of coherence between administrative requirements, political conveniences of the parties and scientific needs.

One of the interpretations considered today as a classic one, the so called “brain drain”, restricted the analysis because it was based only from the perspective of the loss and of the recovery, disregarding all those scientists, who for multiple reasons, persisted in their “drain”.

The “brain gain” or return of the scientists appears as a concrete possibility when developing countries may offer their scientists abroad actual possibilities to return through science and technology policies backed in general with international funds for the support of development.

Thus, as of the decade of the ‘90s, programs oriented to encourage the return of national scientists living abroad, have started to appear and the situation is partially cleared thanks to the generalization of highly efficient communication media such as Internet.

New policies in the recovery of knowledge and of scientific and technological practices are stated which include those developed by emigrant scientists.

Retaking a tradition of decades of migration of Latin American scientists in France and strengthened by the fresh incentive provided by the establishment of networks of Colombian scien-

tists abroad, with the Caldas network a proposal is born to form networks of Latin American scientists living abroad, which seeks to reorient the scientific research potential developed in European laboratories and institutions, towards Latin American countries.

With the support from international organizations, such as the UNESCO, and with the collaboration of French organizations with long experience in international cooperation, such as ORSTOM, taking as axis the networks of Latin American scientists, it is proposed to consolidate the Inter Regional networks, which - with an approach of specific projects - will be directed to strengthen the strategy of internationalizing the scientific and technical activity in Latin America, through programs and projects of international cooperation in scientific research.

The new international context of scientific and technological cooperation seems to help consolidate proposals that, parting from assumptions of democratization of scientific research, seek to implement strategies supporting themselves on the new geopolitical structures resulting after the period of the so called “cold war”.

The strategies for cooperation proposed at the formation of the European Community with respect to Latin America are having a sufficiently significant reception so that an entire battery of programs had been proposed in the past two years : ALFA, Latin America Academic Education, AL-INVEST, to encourage European businessmen in the search for economic partners in the Latin American region and lately, the program URB-AL, to re-launch the cooperation between European and Latin American cities.

The case of France may result particularly illustrative because of the tradition of its relations with Latin America and the historic influence exercised over generations of Latin American intellectuals on the subject of human rights and as “land of asylum”.

Although there were several attempts for getting organized among the Latin American researchers in Europe, particularly in Belgium with the creation of the groups of Latin American students in Louvain-la-Neuve in 1958, many projected attempts for organization remained at the side of the road. Only at the end of the decade, in 1987, an Uruguayan project, with government support, starts to appear as a lasting organizational proposal that is going to be emulated some time later, at the beginning of the nineties, in 1991, with a proposal launched by COLCIENCIAS, the Colombian government agency of science and technology, proposal which is rapidly accepted by the scientists living in France, with respect to a clear political intention to promote a project for modernization of the country through scientific development and international insertion.

Although this analysis, on the one hand, lacks a distance in time, on the other hand, presents an alternative study that can be considered as an advantage since it is an « on the spot » analysis about the construction of networks of Latin American scientists in Europe.

It should be pointed out that this work forms a part of a long term program on the identification of Latin American and Caribbean researchers in Europe and the scientific potential that may be reoriented, through specific projects, toward the Latin American region.

The search for institutionalization of migrations

Migrations of Latin American scientists in Europe are framed within a long and dear tradition of mutual admiration and cultural exchanges, of scientific and technical cooperation and of strategic plans on economic cooperation.

Latin American efforts to establish policies that would be translated into a significant increase

of science and technology production (at an institutional level), in addition to being a rational control on the migration of scientists, dates back to the decade of the ‘60s and ‘70s, with the exception of Brazil, with its Conselho Nacional de Pesquisas (1951), pioneer in its kind in the Continent and of Argentina with its Consejo Nacional de Investigaciones Cientificas y Tecnicas (1958). Out of a total of 24 countries, 15 establish their national councils during these two decades [1].

Today it is accepted without much difficulty, that the migratory flow of the Latin American scientists to Europe, becomes institutionalized, that is, that it starts to obey systematic science and technology policies, as of the ‘60s and that the putting into operating of the science and technology systems is going to permit improvements of control strategies over the migratory flows of scientists. It will not be possible to avoid, however, a lack of articulation of the science and technology systems with respect to the specific social and economic needs of the respective countries.

The Latin American countries start to evaluate the impact of the extent of the migration of its best prepared citizens in scientific and technical activities, when in the regional meetings, and thanks to the comparison of the respective systems, they are able to measure the socioeconomic and political consequences and the implications for the region in its development with the exodus of its scientists.

One of the greatest limitations of the analysis on international scientific migrations from the perspective of the “bran drain” is that it does not consider, in its real dimension, the value of the scientific exchange that takes place with the international migratory movements of scientists.

The old European currents of attraction for the countries of Latin America, were taking form, becoming evident as of the ‘60s, when they started to be expressed with the so called “European Latin Americanism” that is, a great movement of attraction, support and solidarity that sought to establish the cooperation between the sectors of European intellectuals with those of Latin America.

The European Latin Americanism

The so called European Latin Americanism, that is that current of sympathy around the Latin American political, social and cultural production, encouraged by the intellectuals of the European left, dates back to the so called “second Latin American revolutions” (Cuba and Chile), without forgetting the so called “boom” of novelistic of the decades of the ‘60s and ‘70s.

This attraction for Latin Americanism, as refers to the scientific activity, is reinforced by a renewed academic organization and by one coordination on the part of brilliant European Latin Americanists, assisted by Latin American immigrants.

The European interest for Latin America, which extended particularly in France, England, Germany and Italy, naturally without forgetting Spain, posed from the beginning the need to reinforce economic relations, the assistance to scientific and technical cooperation and a constant search for having closer inter-university relations.

In England, as of 1964 and with North American funds, the Latin Americanistic studies were reactivated in five (5) university centers, London, Cambridge, Oxford, Liverpool and Glasgow. It is the famous time of the Institute of Latin American Studies of the University of London, under the direction of John Lynch, who was the coordinator of the Latin American Studies at British Universities in progress and completed.

The attraction to Latin America of the Germans is translated into the availability of well equipped centers, which support original research. In Bonn, for example, the Colombian Rafael Gutierrez Girardot was encouraging a literature workshop, while in Cologne, the venerable Koneztke, presided the 4th Congress of Latin American Historians on Migrations in America.

In Berlin, the Iberian-American Institute has the most complete Latin Americanistic library in Europe -specially on Mexico and Argentina and publishes the Ibero-Amerikanische Archiv.

In 1965, with the aid from the Volskwagen Foundation, the German Association of Researchers on Latin America was created, with headquarters in Hamburg.

In 1967, Professor Hans Albert Steger, published his famous « Research on Latin America in the Federal Republic of Germany and West Berlin » (LARR, No. 2, 1969).

With the creation of the CRAL, Latin America Research Center, professor Giovanni Meo Zilio, creates in Florence, Italy and with the financing from the National Council on Research, a Latin Americanistic current with a European projection.

Latin Americanism in Spain and Portugal, countries so directly connected by historical, social and cultural reasons with Latin America, does not appear in these decades as really significant.

The Institute of Hispanic Culture, financed by the Ministry of Foreign Relations inspired on Hispanic doctrines (Franquism and Opus Dei) is directed by the Duke of Cadiz, Alfonso de Borbon Dampierre, with a considerable number of scholarships, libraries, museums, magazines and the Hispanic American Association of History.

The School of Hispanic American Studies, located in Seville, was created by the Superior Council of Scientific Research, controlled at that time by the Opus Dei.

On the other hand, there are the Institute of Political Studies for Latin America of Madrid, the Catholic Institute of Social Studies of Barcelona and the Journal “Iberian-American Archives” by the Franciscan fathers, all three with a religious orientation and specialized in the Colonial period, of an erudite documentary type that usually take advantage of the files of Seville and Simancas. With the Austrian Institute for Latin America, founded in 1965 in Vienna, and the International Instituut voor Social Geschiedenis of Amsterdam, true Center of History Studies of the Labor and Social Movement, with valuable funds on Latin America managed by Rudolf de Jong, we find the Center of Latin American Studies and Documentation, that since 1969 guaranteed the edition of the Directory of European Latin Americanistics and published the Bulletin of Latin American and Caribbean Studies.

In Stockholm is NOSALF, the Scandinavian Association of Latin American Research which operates in the Institute of Latin American Studies in Stockholm, which publishes in addition the magazine Research News and Principal Acquisitions of Documentation on Latin America in Denmark, Finland, Norway and Sweden.

Switzerland is particularly prolific in the production on Latin America, being the seat of the FERES, International Federation of Catholic Institutes of Social and Socio-religious Research, permanently oriented by the Belgian François Houtard.

The Declaration of Mexico in 1974, clearly illustrates the concern posed by the problem of migrations of scientists in Latin America. In addition to the complaints made by the countries with better scientific and technological development, and of their tactics for recruiting Latin American scientists (specially United States and Europe), international organizations are called upon to take part with proposals that will put an end or at least reduce those constant “drains” of scientists.

However, the solutions proposed at that time, were not able to decrease the tendencies of the migratory flows of scientists.

The explanations based on the proposals of the centers and the peripheries turned out to be

insufficient and the migrations continue. In the decade of the ‘80s, the migrations of Latin American scientists were highly favored with the arrival of military sectors to the political power and even though only until now the impact caused by such political situation on the mobility of Latin American scientists, specially the South of the Continent is starting to be established, it is considered that the influence was very significant.

But in the decade of the ‘80s we also find ourselves with another type of forces, those that promote dynamics of scientific migrations, which for the European case and through the European Community, present strategies to rationalize the mobility of scientists seeking that the countries of origin will channel benefits through scientific and technical cooperation, promoted from the Inter-parliamentary Conferences between 1974 and 1991.

Scientific and technological cooperation between Europe and Latin America

The search for scientific and technological cooperation between Europe and Latin America has been permanently promoted from government levels, such as the Inter-parliamentary Conferences, but the efforts invested have not always corresponded to the poor results obtained.

It is necessary to recognize, however, two major aspects : on the one hand, the political willingness by the governments to evidence the central place that is going to be held by science and technology in the sustained development of the region in order that there will be a continuity in scientific and technological cooperation and, on the other hand, an interest for the consolidation of said cooperation with solid financial resources and a permanent innovation of programs.

For these reasons, the scientific and technological cooperation between Latin America and Europe results highly significant when in a series of bi-regional conferences held from 1974 to 1991, the idea is to launch an offensive directed towards the institutionalization and consolidation of research in cooperation.

The First Conference (1974) established exact measures to improve technical cooperation, the III Conference (1977), states the need to use funds from the European Community for financing the expenses of technological transfer. The VI Conference (1983) calls upon Latin America to make its own technologies, adequate to its needs.

The program “Science and technology at the service of development” initiated in 1983, promotes projects in agriculture, medicine, sanitation and nutrition.

With the implementation of the program “International Scientific Cooperation”, which seeks to promote mobility among scientists, associate research centers in the regions and promote ties between scientific communities, the purpose is to strengthen the cooperation agreements with Mexico (1975), Brazil (1980), the Andean Pact (1983) and Central American countries (1985).

It is interesting to point out that the IX Conference (1989) established that the industrial, scientific and technical cooperation turned out to be the most appreciated assistance in order that Latin America could secure its economic growth.

In the Orientations of 1990, the European Economic Community defined as priority areas the quality of life, a better use of the natural resources and the respect for the environment. In the Declaration of Rome, of the same year, the countries member of the European Community declare their willingness to extend the opportunities of cooperation with the countries of the Group of Rio.

On April 26 and 27, 1991, the First Institutionalized Ministerial Meeting between the European

Community and the Group of Rio, the Ministers of the European Community state their interest in that the member countries of the Group of Rio participate in specific research programs.

The X Conference (1991) points out the increasing importance that the European Community grants to science and technology, translated into programs such as “Science and Technology at the service of Development” and “International Scientific Cooperation”.

In the Second Ministerial Meeting between the European Community and the Group of Rio, from May 28th to 29th, 1992, two priority subprograms are pointed out within the Community Frame Program for Science and Technology : the sector of Environment and the subprogram of Science of Living Beings.

The case of France

The attraction between Latin American and French people dates back in history to Bolivar the Liberator who arrived completely bewitched to the crowning of Bonaparte in Notre Dame and to the seduction of Antonio Nariño by that land of the Right of Man. On the part of the French, it starts in the wars of Independence where they fought together with the liberating armies. The interest of Latin American scientists towards France has not vanished, notwithstanding the passage of time, that spontaneous and fresh admiration of the time of the Independence.

As the interest has been mutual, Paris continues being, for political and administrative reasons, a pioneer center where the attraction for everything related to Latin America started to extend throughout Europe. Apart from the high number of publications, whether specialized or general, Paris is characterized by being a center that gathers the attraction of French and European intellectuals for Latin America.

In addition to the Institute of High Studies for Latin America, the currents of attraction for Latin America have been nourished with the support of illustrious intellectuals, passing through sociologist such as Alain Touraine, not forgetting Claude Levi-Strauss, Francis Perraux, Marcel Bataillon, Alain Rouquie, and militant writers such as Regis Debray.

It is recognized without any doubt, that the contribution by the individualities has played a central role in the relations between French and Latin American intellectuals. Thus, the efforts made in sociology, anthropology, ethnology, political sciences, with the formation in doctorates, technical assistance in the development of agriculture and farming activity, continuing with the most recent line of administrative decentralization and the support of cultural exchanges with the promotion of meetings already widely institutionalized.

By being pioneer, France could not but inherit and contribute to develop the new tendencies of the communities of Latin American scientists that start to understand the huge possibilities that may be offered by the scientific and technological acquisitions and activities developed in the investigative practice of the French scientific community.

The French-Latin American relations may be illustrated with the case of the French Institute of Andean Studies (founded in Lima in 1948) that covered several disciplines as Archeology, Paleontology, Geology and Anthropology.

The Institute, by establishing its vocation of “being a connecting organization between Latin American men of science and the scientific means of France and of French language interested in Andean subjects” [2], indicated since then, one of the fundamental constants of French-Latin American cooperation.

It should no be forgotten how the efforts to rationalize the migratory flows of scientists, have

been permanently reinforced by international organizations such as the UNESCO which since 1952 has given its assistance in the field of design of scientific and technological policies in Latin America. Thus, with the meeting in Castala (1965) four meetings of Permanent Conferences of the National Councils of Scientific and Research Policy of the member States of Latin America were summoned : Buenos Aires, 1966 ; Caracas, 1969 ; Viña del Mar-Santiago Chile, 1971 ; Mexico, 1974.

Seeking an increasing improvement of the French-Latin American relations, the governments have promoted the Mixed Commissions in order to better detect mutual interests. Thus, the officialization of the agreements and covenants between laboratories, organizations and institutions, establishes axis that start to offer better results as the official entities obtain the advise from direct knowledgeable people on the subject of programs that may be oriented in the binational panoramas.

On the other hand, the political and social conditions of the Continent have influenced the waves of migrations of scientists, obeying to exact political conditions : Chile since 1973 and in general the Southern Cone during the decade of the ‘80s, under military dictatorships.

Latin American networks of scientists in France

With some particularly favorable conditions during the decade of the ‘70s with respect to Latin American scientists, France launches an offensive of institutionalization of scientific and technological activities through the Mixed Commissions, commissions that seek to promote cooperation in terms of equality of the participation, particularly as refers to government commitments [3].

However, the lack of continuity in the financing of the programs and projects rapidly detracts from the willingness by university sectors to guarantee research in cooperation. Again, the constancy of individualities and the isolated efforts by a few institutions, prevents the agreements to be completely terminated by non-fulfillment by the governments.

It is in 1987 when a group of Uruguayan professionals, mostly physicians, with relations in international organizations such as the UNESCO, launch a proposal to create a network of scientists resident in France, inserted in the scientific community, seeking to draw the attention of the governments with respect to the need to create a program that would guarantee the return of the researchers formed in Europe [4].

The program has a relative success and is able to institutionalize not only the return of many professionals, but, in addition, establish a cooperation in research that today continues producing fruits. In 1991, and thanks to the invitation made by the director of the agency for the development of science and technology in Colombia, a group of researchers meets to listen to a proposal : that of getting interested in the country, of establishing contacts with groups of national researchers and of making efforts to promote research programs and projects, not necessarily returning to the country.

Given the express political will, translated into a new Constitution that starts to rule as of 1991, and in accordance with the new international panorama of scientific and technological activities, strongly encouraged by the development of communications, particularly the generalization of the use of Internet, Colombian researchers create an association of law 1901 (non lucrative), the ACASTC [5].

In order to integrate the scientists, the association is fitted with an efficient and particularly useful means in the consolidation of an association : the electronic mail. In addition, the idea is to take advantage of the French environment, then the most interesting resource at the time is the

MINITEL, a technological product typically French and of high technical performance in relation to its utilization cost.

The creation of the electronic network is supported by COLCIENCIAS and thanks to the interest by CERMA [6] and the experts in information sciences from Colombia working there, an electronic network is installed which is going to permit a wide coverage in the communication of Colombian scientists in France and with their national peers in Colombia.

On the other hand, the French government, through the Ministry of Foreign Relations, becomes interested in the Colombian project and decides to cooperate for the funding of a National Science and Technology Plan, a financing plan coming from the IDB (Interamerican Development Bank), an important administrative restructuration within COLCIENCIAS, a political willingness by the government and by Colombian scientists abroad, are probably some of the reasons that very rapidly promoted the creation of other nodes of Colombian scientists in 22 countries of the world.

Given the particularly close relations between Colombian and French scientists, with significant historic background that go from the huge individual and institutional efforts up to the agreements of cooperation between government, going through huge cultural tasks, the consolidation of the ACAST is made relatively fast, thanks to previous initiatives but which in general were reduced to a level of two or three university institutions and to the enormous efforts by French specialists in Colombia.

The strategy of making visible the efforts of the national activities in science and technology seeking international cooperation, starts to be translated into international acts that permit the meeting of national scientists with their French peers.

Thus, in 1993, the ACASTC organizes with the concurrence by the Colombian Delegation before the UNESCO and the Colombian embassy in France, “Colombie : carrefour de l’avenir. Premier Forum scientifique en France” [7].

This meeting of French and Colombian scientists supported by government representatives, permits the ACASTC to initiate a presence in the scientific means of the French community, a presence that will be consolidated in the spring of 1994 with the first French-Colombian Colloquium of Social Sciences, ENLACES [8].

The Colombian initiative, however, does not remain in the framework of the promotion of national scientific activities. In the context of the international scientific community and with new cooperation parameters, particularly promoted as of the European Union with several programs oriented towards Latin America, the ACASTC starts to explore the possibilities offered by the bi-regional cooperation between Latin America and the European Union.

Thanks to a great mobility and to an increasing multi-disciplinary capacity, the association starts to look for the support from other Latin American associations of scientists residents in France created since the beginning of the ‘80s. Thus, given a convergence of objectives and a confluence of actions, the meeting with other networks of Latin American scientists is the result of a strategy that seeks to internationalize science and technology in Colombia.

It is agreed, then, with the group of scientists from Latin America and the Caribbean residents in developed countries and grouped in ALAS, Latin American Association of Scientists, associated with the ACAL, Academy of Sciences of Latin America, with the sponsorship by the Committee of Science and Technology for the developing countries (COSTED), of the International Council of Scientific Unions (ICSU) supported by the UNESCO through its Regional Office for Science and Technology (ORCYT), Montevideo, to promote the creation of the Inter Regional Network of Latin American and Caribbean Scientists, to explore the potential acquired by Latin American scientists abroad [9].

Supported on the electronic forum for discussion on : “The networks of Science : international

scientific migrations and the networks of Latin American scientists abroad", the Inter Regional network organizes a Round Table at the headquarters of UNESCO in Paris, on May 21, 1996 [10].

These activities permit to expand the space of relations between the Latin American scientists residing in France interested in the research in cooperation with their countries of origin, supported by the French researchers specialized in Latin America.

In addition, the consolidation of a data base of Latin American scientists abroad starts to establish platforms that, through specific programs and projects in scientific cooperation, reorient the scientific and technological potential developed by the Latin American and Caribbean researchers abroad. The increasing importance of the Latin American researchers and scientists abroad starts to become evident with the supports created at a national level in the Latin American universities.

The promotion of the scientific regionalization through the electronic networks of exchange of knowledge and the search for cooperation projects supported by regional entities such as the CRESAL (Regional Commission of Higher Education for Latin America) and the groups of universities of the south.

The generalization of Internet networks in the Latin American countries gives a great impulse to communications and notwithstanding the evident technical obstacles, the extension of Internet continues advancing with different proposals of alternative and technically efficient technologies such as the Linux Operational System [11], proposals that start to show real alternatives with accessible costs for organizations, laboratories and universities of provinces with modest budget allocations.

On the other hand, the regional initiatives find reinforcement in the establishment of International Relations Offices-ORI, which are presented as bridges between the institutions and their national peers abroad.

The proposals of the European Union through programs oriented to promote scientific, technological, commercial, industrial and cultural relations, are at the same time reinforcing the inter-regional relations and according to official evaluations, the receipt of the approximation strategies has been a complete success, so much that it has promoted another series of proposals that translate into programs such as, URB-AL, a program oriented to encourage the Europe-Latin America exchange at the level of cities [12].

Conclusions

As it has been possible to evidence briefly, there is a tradition with deep roots which has encouraged cultural, scientific and technological relations between Europe and Latin America.

The personal relations, deep and dating far back between scientists, have played a significant role in the beginning of the institutionalization of cooperation exchanges between European and Latin American regions.

France, being a pioneer in such exchanges, continues being a central actor in the scientific relations with the Latin American communities and the Mixed Commissions, with increasingly regular meetings, are the ones that mark the rhythm of cooperation.

Currently there is a scientific and technological potential which has started to be identified and explored on the part of the Latin America scientific community. The reinforcement of the networks of scientists settled in Europe starts to generate significant benefits, direct products of the exchange and of the potential developed by the Latin American researchers living abroad. Thus, thanks to the initiatives of the associations of Latin American scientists and of their

European peers, a strategy for approximation through programs and projects of scientific research in cooperation has started to be promoted, permitting, in addition, that the design of policies in Science and Technology will take into consideration the groups living abroad. Also, the European Union has created a series of cooperation programs, ALFA, AL-INVEST, URB-AL, etc. which seek a more dynamic inter-regional approximation marked essentially by inter-university, commercial and industrial relations and promotion of inter-regional relations.

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[11] As early as 1994 ACASTC made a proposal to colombian universities to implement the Operational System Linux. Universidad del Valle accepted the proposal and both institutions stablished the "Centro Linux de la Universidad del Valle". On the other hand, a program to generalize Linux at a national scale is being promoted by province universities with the support of RedCol.

[12] URB-AL is a program of decentralized cooperation of the European Commission, stablished in december/95 and oriented to the municipalities, regions and other representative instances of local colectivities and territories of the European Community and Latin America.

Migraciones científicas internacionales : 25 años de migraciones de científicos latinoamericanos en Europa El caso de Francia (1970-1995)

Guillermo Lozano

Introducción

El análisis de las migraciones de científicos latinoamericanos en Europa se propone diseñar y establecer estrategias para identificar el potencial científico y técnico de los científicos latinoamericanos que se encuentran vinculados a las comunidades científicas en Europa.

El presente trabajo se orienta hacia todos aquellos que decidieron emigrar y permanecer en el exterior, vinculándose a las comunidades de científicos en Europa. Intenta señalar cómo un potencial científico y tecnológico ha sido desarrollado, y como dicho potencial, puede ser, dentro del nuevo contexto internacional del desarrollo de las ciencias y las tecnologías, un recurso valioso para las comunidades científicas latinoamericanas que buscan posicionarse en el escenario internacional de la ciencia.

La problemática de las Migraciones Científicas Internacionales se plantea hoy desde la globalización de la economía, desde los nuevos aportes interpretativos de las Ciencias Sociales, desde los nuevos avances de las tecnologías de la comunicación y por supuesto, desde la perspectiva de la rápida expansión de las redes de científicos en todo el mundo. El caso de las migraciones de los científicos latinoamericanos en Europa es bastante ilustrativo, ya que comporta una rica tradición de relaciones de cooperación cultural, reforzada por las viejas corrientes latinoamericanistas que han buscado expresarse en políticas regionales de cooperación e investigación. de otra parte, las políticas de América Latina frente al éxodo de sus científicos presentan resultados muy mediocres, cuando no completamente desastrosos. Las llamadas políticas de recuperación, los programas de retorno, se han visto generalmente fragilizados por una ausencia de coherencia entre los imperativos administrativos, las conveniencias políticas partidistas y las necesidades científicas.

Una de las interpretaciones considerada hoy en ida como clásica, la llamada del « brain drain », o « fuga de cerebros », restringió los análisis, porque se fundamento solo desde la perspectiva de la perdida y de la recuperación, desatendiendo todos aquellos científicos, quienes por Multiples razones, persistían en su « fuga ».

El « Brain Gain » o « retorno de cerebros » aparece como una posibilidad concreta para que los paises en desarrollo puedan ofrecer a sus científicos en el exterior posibilidades reales de retorno a través de políticas de ciencia y tecnología apoyadas en general con fondos internacionales de apoyo al desarrollo. Es así que a partir de la década de los 90, programas orientados a estimular el regreso de los científicos nacionales en el exterior, han comenzado a aparecer y la situación se despeja parcialmente gracias a la generalización de medios de comunicación altamente eficaces como Internet. Se plantean nuevas políticas en la recuperación del saber y de las practicas científicas y tecnológicas que incluyen aquellas desarrolladas por los científi-

cos emigrantes. Recogiendo una tradición de décadas de migración de científicos latinoamericanos en Francia y fortalecidos por los impulsos frescos proporcionados por la constitución de redes de científicos colombianos en e exterior, con la Red Caldas, nace una propuesta de conformar redes de identificas latinoamericanos residentes en el exterior, que busca reorientar el potencial científico investigativo desarrollado en laboratorios e instituciones europeas, hacia los países latinoamericanos. Con el apoyo de los organismos internacionales, como la UNESCO, y con la ayuda de organismos franceses de vieja trayectoria en la cooperación internacional, como el ORSTOM, el Instituto Francés de la Investigación Científica por el desarrollo en Cooperación, teniendo como ejes las redes de científicos latinoamericanos, se propone consolidar las redes Inter-Regionales, que con un enfoque de proyectos específicos, apunten a fortalecer la estrategia de internacionalizar la actividad científica y técnica en América Latina, a través de programas y proyectos de cooperación internacional en la investigación científica.

El nuevo contexto internacional de la cooperación científica y tecnológica parece ayudar a consolidar propuestas que, partiendo de presupuestos de democratización de la investigación científica, buscan implementar estrategias apoyándose en las nuevas estructuras geopolíticas surgidas después del periodo de la llamada « guerra fría ».

Las estrategias de cooperación propuestas a partir de la Comunidad Europea frente a América Latina están teniendo una receptividad lo suficientemente significativa para que toda una batería de programas haya sido propuesta estos últimos dos años : ALFA, América Latina Formacion Academica, AL-INVEST, para estimular los empresarios europeos en la búsqueda de socios económicos en la región latinoamericana y últimamente, el programa URB-AL, para relanzar la cooperación entre las ciudades europeas y latinoamericanas.

El caso de Francia puede resultar particularmente ilustrativo por la tradición de sus relaciones con América Latina y la influencia histórica ejercida sobre generaciones de intelectuales latinoamericanos en materia de derechos del hombre y como « tierra de asilo ». Aunque hubo varios intentos de organización entre los investigadores latinoamericanos en Europa, particularmente en Bélgica con la creación de grupos de estudiantes latinoamericanos en Louvaine-la-Neuve en 1958, muchos proyectos de intentos de organización quedaran al borde del camino. Tan solo a finales de la década, en 1987, un proyecto uruguayo, con apoyo gubernamental comienza a perfilarse como una propuesta organizativas duradera que va a ser emulada un poco mas tarde, a comienzos de los noventa, en 1991, con la propuesta lanzada por COLCIENCIAS, la agencia gubernamental colombiana de la ciencia y la tecnología, propuesta que es rápidamente acogida por los científicos residentes en Francia, frente a una clara voluntad política de impulsar un proyecto de modernización del país por la vía del desarrollo científico y de la inserción internacional. Si bien el presente análisis, adolece de una falta de distanciamiento en el tiempo, de una parte, por otro lado, presenta una alternativa de estudio que puede ser considerada como una ventaja, ya que es un análisis sobre el terreno sobre la construcción de redes de científicos latinoamericanos en Europa.

No sobra señalar, que el presente trabajo hace parte de un programa de largo aliento sobre la identificación de los investigadores latinoamericanos y del Caribe en Europa y el potencial científico que puede reorientarse, a través de proyectos específicos, hacia la región

La búsqueda de la institucionalización de las migraciones

Las migraciones de científicos latinoamericanos en Europa se inscriben en una vieja y cara tradición de admiraciones mutuas y de intercambios culturales, de cooperación científica y técnica y de planes estratégicos sobre cooperación económica.

Los esfuerzos latinoamericanos por establecer políticas que se tradujeran en un significativo aumento de la producción de CyT (a nivel institucional), además de ser un control racional sobre la migración de los científicos, se remonta a la década de los 60 y 70, con la excepción del Brasil, con su Consejo Nacional de Pesquisas (1951), pionero en su genero en el Continente, y de la Argentina con su Consejo Nacional de Investigaciones Científicas y Técnicas (1958). De un total de 24 países, 15 establecen sus Consejos nacionales durante estas dos décadas [1].

Hoy se acepta sin mayores dificultades, que el flujo migratorio de los científicos latinoamericanos hacia Europa, se institucionaliza, es decir que comienza a obedecer a políticas sistemáticas de CyT, a partir de los años 60 y que la puesta en marcha de los Sistemas de CyT va a permitir mejorar las estrategias de control de los flujos migratorios de los científicos. No se podrá evitar, sin embargo, una falta de articulación de los sistemas de CyT respecto de las necesidades sociales y económicas especificas de los respectivos países.

Los países latinoamericanos comienzan a evaluar el impacto de la dimensión de la migración de sus ciudadanos mejor preparados en las actividades científicas y técnicas, cuando en los encuentros regionales, y gracias a la comparación de los respectivos sistemas, pueden medir las consecuencias socioeconómicas y políticas y las implicaciones para la región en su desarrollo, con el éxodo de sus científicos.

Una de las limitaciones mayores de los análisis sobre las migraciones científicas internacionales desde la perspectiva del « Brain drain » es que no considera, en su dimensión, el valor del intercambio científico que se produce con los movimientos migratorios internacionales de científicos.

Las viejas corrientes europeas de simpatía por los países de América Latina, fueron tomando forma, decantándose, a partir de los años 60, cuando se comenzaron a expresar con el llamado « Latinoamericanismo Europeo », es decir, un gran movimiento de simpatía, de apoyo y solidaridad, que buscaba establecer la cooperación entre los sectores de intelectuales europeos con los latinoamericanos.

El latinoamericanismo europeo

El llamado latinoamericanismo europeo, es decir aquella corriente de simpatía alrededor de la producción política, social y cultural latinoamericanas, animada por los intelectuales de la izquierda europea, se remonta a las llamadas « segundas revoluciones latinoamericanas » (Cuba y Chile), sin olvidar el llamado « boom » de la novelística de las décadas de los 60 y 70.

Esta simpatía por el latinoamericanismo, en cuanto actividad científica, se ve reforzada por una renovada organización académica y por una coordinación de parte de brillantes animadores latinoamericanistas europeos, ayudados por latinoamericanos immigrantes.

El interés europeo por América Latina, que se extendió particularmente en Francia, Inglaterra, Alemania e Italia, sin por supuesto olvidar España, planteo desde un principio la necesidad de reforzar las relaciones económicas, las ayudas a la cooperación científica y técnica y una búsqueda incesante por estrechar las relaciones inter-universitarias.

En Inglaterra, a partir de 1964 y con fondos norteamericanos, se reactivan los estudios latinoamericanistas en cinco (5) centros universitarios, Londres, Cambrigde, Oxford, Liverpool y Glasgow. Es la famosa época del Institute of Latin American Studies of the University of London, bajo la dirección de John Lynch, quien era el coordinador del Latin American Studies at British Universities in Progress and Completed.

Las simpatías latinoamericanas de los alemanes se traducen en la disposición de centros bien dotados, que apoyan investigaciones originales. En Bonn por ejemplo, el colombiano Rafael Gutiérrez Girardot, animaba un taller de literatura mientras que en Colonia, el venerable Koneztkc, presidía el 4° Congreso de Historiadores Latinoamericanistas sobre Migraciones en América.

En Berlín, el Instituto iberoamericano posee la mas nutrida biblioteca latinoamericanista en Europa- especialmente sobre México y Argentina y edita el Ibero-Amerikanische Archiv.

En 1965, con el auxilio de la Fundación Wolkswagen, se creo la Asociación Alemana de Investigaciones sobre América Latina, con sede en Hamburgo. En 1967, el profesor Hans Albert Steger, publicaba su famoso « Research on Latin America in the Federal Republic of Germany and West Berlin » (LARR, N°2, 1969).

Con la creación del CRAL, Centro Ricerche America Latina, el profesor Giovanni Meo Zilio, crea en Florencia, Italia, y con financiamiento del Consejo Nacional de Investigaciones, una corriente latinoamericanista con proyección europea

El Latinoamericanismo en España y Portugal, países tan directamente vinculados por razones históricas, sociales y culturales con América latina, no aparece en estas décadas como realmente significativo.

El Instituto de Cultura Hispánica, financiado por el Ministerio de Relaciones Exteriores con inspiración en las doctrinas de la Hispanidad (franquismo y Opus Dei) es dirigido por el Duque de Cádiz, Alfonso de Borrón Dampierre, con un considerable numero de becas, bibliotecas, museos, revistas y la Asociación Hispanoamericana de Historia. La Escuela de Estudios Hispano-Americanos, con sede en Sevilla, fue creada por el Consejo Superior de Investigaciones Científicas, controlado en la época por el Opus Dei.

De otra parte, se encuentran el Instituto De Estudios políticos para América Latina de Madrid, el instituto Católico de Estudios Sociales de Barcelona y la Revista « Archivo Ibero-americano » de los franciscanos, todos tres de orientación religiosa y especializados en el período Colonial, de tipo erudito documental que suelen aprovechar los archivos de Sevilla y Simancas. Con el Instituto Austríaco para América Latina, fundado en 1965 en Viena, y el International Instituut voor Social Geschiedenis de Amsterdam, verdadero Centro de Estudios de Historia del Movimiento Obrero y Social, con fondos valiosos sobre América Latina administrados por Rudolf de Jong, encontramos el Centro de Estudios y Documentación Latinoamericanos, que desde 1969 aseguraba la edición del Directorio de Latinoamericanistas Europeos y editaba el Boletín de Estudios Latinoamericanos y del Caribe.

En Estocolmo esta el NOSALF, la Asociación Escandinava de Investigación Latinoamericanista que funciona en el Instituto de Estudios Latinoamericanos de Estocolmo, que editan además la revista Research News and Principal Adquisitions of Documentation on Latin American in Denmark, Finland, Norway and Sweden. Suiza es particularmente prolífica en la producción sobre América Latina, siendo sede del FERES, Federación Internacional de los Institutos católicos de Investigaciones Sociales y Socio-religiosas, orientadas permanentemente por el belga François Houtard. La Declaración de México en 1974, ilustra claramente la inquietud que plantea el problema de las migraciones de científicos en América Latina. Además de las denuncias de los países con mejor desarrollo científico y tecnológico, y de sus tácticas de reclutamiento de científicos latinoamericanos (especialmente estados Unidos y Europa), se lanzan llamados a los organismos internacionales para que intervengan con propuestas que pongan fin, o al menos reduzcan, esas constantes « fugas » de los científicos.

Sin embargo, las soluciones propuestas en aquellos momentos, no lograron disminuir las tendencias de los flujos migratorios de los científicos. Las explicaciones basadas en las propuestas de los centros y las periferias resultaron insuficientes y las migraciones continúan. En la década de los 80, las migraciones de científicos latinoamericanos se vieron altamente favorecidas con la

llegada de sectores militares al poder político y aunque sólo hasta ahora se comienza a establecer con mayor precisión el impacto que tuvo esta coyuntura política sobre la mobilidad de los científicos latinoamericanos, especialmente al Sur del Continente, se considera que la influencia fue bastante significativa.

Pero en la década de los 80, también nos encontramos con otro tipo de fuerzas, aquellas que impulsan dinámicas de migraciones científicas, que para el caso Europeo y a través de la Comunidad Europea, plantea estratégias para racionalizar la mobilidad de los científicos buscando que los países de origen canalicen beneficios a través de programas de cooperación científica y técnica, impulsados desde las Conferencias Interparlamentarias entre 1974 y 1991.

La cooperación científica y tecnológica entre Europa y América Latina [2].

La búsqueda de la cooperación científica y tecnológica entre Europa y América Latina ha estado permanentemente impulsada desde las instancias gubernamentales, como las Conferencias Interparlamentarias, pero los esfuerzos invertidos no siempre han correspondido a los magros resultados obtenidos.

Es necesario reconocer sin embargo, dos aspectos centrales : de una parte la voluntad política de los gobiernos al constatar el lugar central que va a ocupar la CyT en el desarrollo sostenido de la región para que exista una continuidad en la cooperación científica y tecnológica y de otro lado, un interés por que dicha cooperación se consolide con recursos financieros sólidos y una innovación permanente de los programas.

Por estas razones, la cooperación científica y tecnológica entre América Latina y Europa resulta altamente significativa, cuando en una serie de Conferencias birregionales que se realizaron entre 1974 y 1991, se busca lanzar una ofensiva que apunte hacia la institucionalización y consolidación de la investigación en cooperación.

La Primera Conferencia (1974) estableció medidas precisas para mejorar la cooperación técnica, la III Conferencia (1977), plantea la necesidad de utilizar fondos de la Comunidad Europea para la financiación de los gastos de la transferencia tecnológica. La VI Conferencia (1983), hace un llamado para que América Latina desarrolle sus propias tecnologías, adecuadas a sus necesidades.

El programa « Ciencia y tecnología al servicio del Desarrollo » iniciado en 1983, impulsa proyectos en la agricultura, la medicina, la sanidad y la nutrición.

Con la implementación del programa « Cooperación Científica Internacional », que busca fomentar la movilidad entre los científicos, asociar los centros de investigación en las regiones y fomentar los vínculos entre las comunidades científicas, se busca fortalecer los acuerdos de cooperación con México (1975), Brasil (1980), el Pacto Andino (1983) y los países de Centro América (1985).

Resulta interesante señalar que la IX Conferencia (1989) estableció que la cooperación industrial, científica y técnica resultaba ser la ayuda mas apreciada para que América Latina pudiera asegurar su crecimiento económico.

En las Orientaciones de 1990, la Comunidad Económica Europea definió como hàbitos prioritarios la calidad de la vida, una mejor utilización de los recursos naturales y el respeto del medio ambiente. En la Declaración de Roma, del mismo año, los países miembros de la CE declaran su voluntad de ampliar las oportunidades de cooperación con los países del Grupo de Río.

El 26 y 27 de Abril de 1991, la Primera Reunión Ministerial Institucionalizada entre la CE y el Grupo de Río, los Ministros de la CE manifiestan su interés en que los países miembros del Grupo de Río participen en programas específicos de investigación.

La X Conferencia (1991) señala la creciente importancia que la CE concede a la ciencia y la tecnología, traducida en programas tales como « Ciencia y Tecnología al servicio del Desarrollo » y « Cooperación científica internacional ».

En la Segunda Reunión Ministerial entre la CE y el Grupo de Río, del 28 al 29 de Mayo de 1992, se señalan dos subprogramas prioritarios dentro del Programa Marco Comunitario para la Ciencia y la Tecnología : el sector del Medio Ambiente y el subprograma de las Ciencias de los Seres Vivos.

El caso de Francia

La atracción entre latinoamericanos y franceses se remonta en la historia hasta el Libertador Bolívar quien llego completamente hechizado a la Coronación de Bonaparte en Notre Dame y a la seducción de Antonio Nariño por estas tierras de los Derechos del Hombre. De la parte de los franceses comienza en las guerras de Independencia en donde combatieron junto con los ejércitos libertadores. El interés de los científicos latinoamericanos hacia Francia no ha perdido, a pesar del paso del tiempo, esa admiración espontanea y fresca de la época de la Independencia.

Como el interés ha sido mutuo, París sigue siendo, por razones politico-administrativas, un centro pionero en donde las simpatías por todo lo relacionado con América Latina comenzaron a extenderse por todo Europa. aparte del numero elevado de publicaciones, ya sean especializadas, ya generales, París se caracteriza por ser un centro que aglutina las simpatías de los intelectuales franceses y europeos por América Latina.

Además del Instituto de Altos Estudios para América Latina, las corrientes de simpatía por América Latina se han alimentado con el apoyo de ilustres intelectuales, pasando por los sociólogos como Alain Tourain, sin olvidar Claude Levi-Strauss, Francis Perraux, Marcel Bataillon, Alain Rouquie, y escritores militantes como Regis Debray.

Se reconoce sin duda, que el aporte de las individualidades ha jugado un papel central en las relaciones entre los intelectuales franceses y los latinoamericanos. Así, los esfuerzos realizados en la sociología, antropología, etnología, las ciencias políticas, con la formación en doctorados, la asistencia técnica en el desarrollo de la agricultura y la actividad agropecuaria, continuando con la línea mas reciente de la descentralización administrativa y el impulso a los intercambios culturales con la promoción de encuentros ya ampliamente institucionalizados.

Al ser pionera, Francia no podía sino heredar y contribuir a desarrollar las nuevas tendencias de las comunidades de científicos latinoamericanos que comienzan a entender las enormes posibilidades que pueden ofrecer las adquisiciones y actividades científicas y tecnológicas desarrolladas en la practica investigativa de la comunidad científica francesa. Las relaciones franco-latinoamericanas pueden ilustrarse con el caso del Instituto Francés de Estudios Andinos (fundado en Lima en 1948) y que abarcaba varias disciplinas como la Arqueología, la Paleontología, la Geología y la Antropologia. El Instituto, al establecer su vocación de « ser un organismo de enlace entre los hombres de ciencia de América Latina y los medios científicos de Francia y de idioma francés interesados en los temas andinos » [3], señalaba desde entonces, una de las constantes fundamentales de la cooperación franco-latinoamericana. No hay que olvidar como los esfuerzos por racionalizar los flujos migratorios de los científicos, se han

visto permanentemente reforzados por organismos internacionales como la UNESCO que desde 1952, ha prestado su asistencia en el campo del diseño de las políticas científicas y tecnológicas en América Latina. Así con la reunión de Castala (1965) se convocaron cuatro reuniones de las Conferencias Permanentes de los Consejos Nacionales de Política Científica y de Investigación de los Estados miembros de América Latina : Buenos Aires, 1966 ; Caracas, 1969 ; Viña del Mar-Santiago de Chile,1971 ; México, 1974.

Buscando mejorar cada vez las relaciones franco-latinoamericanas, los gobiernos han impulsado las Comisiones Mixtas para mejor detectar los intereses mutuos. Así, la oficializaron de los acuerdos y convenios entre laboratorios, organismos e instituciones, establece ejes que comienzan a ofrecer mejores rendimientos en la medida en que las instancias oficiales se asesoran de los conocedores directos sobre el terreno de los programas que pueden orientarse en los cuadros binacionales.

De otro lado, las condiciones políticas y sociales del Continente han influido en olas de migraciones coyunturales de científicos, obedeciendo a condiciones políticas precisas : Chile desde 1973 y en general el Cono Sur durante el decenio de los años 80, bajo las dictaduras militares.

Redes latinoamericanas de científicos en Francia

Con unas condiciones particularmente favorables durante la década de los 70 frente a los científicos latinoamericanos, Francia lanza una ofensiva de institucionalización de las actividades científicas y tecnológicas a través de las Comisiones Mixtas, comisiones que buscan impulsar la cooperación en términos de igualdad de la participación, particularmente en lo que tiene que ver con los compromisos gubernamentales [4].

Sin embargo, la ausencia de continuidad en la financiación de los programas y proyectos degrada rápidamente la voluntad de sectores universitarios por garantizar la investigación en la cooperación. De nuevo, la constancia de las individualidades y los esfuerzos aislados de instituciones muy contadas, impiden que los acuerdos se rompan totalmente por incumplimiento de los gobiernos.

Es en 1987, cuando un grupo de profesionales uruguayos, médicos en su mayoría, con relaciones en organismos internacionales como la UNESCO, lanzan una propuesta de crear una red de científicos residentes en Francia, insertos en la comunidad científica, buscando llamar la atención de los gobiernos frente a la necesidad de crear un programa que garantice el retorno de los investigadores formados en Europa [5].

El programa tiene un relativo éxito y logra institucionalizar no solo el retorno de muchos profesionales, sino que además, logra establecer una cooperación en la investigación que sigue hoy rindiendo sus frutos. En 1991, y gracias al llamado del director de la agencia por el desarrollo de la ciencia y la tecnología en Colombia, un grupo de investigadores se reúne para escuchar una propuesta : aquella de interesarse por el país, la de establecer contactos con los grupos de investigadores nacionales y la de procurar impulsar programas y proyectos de investigación, sin necesariamente regresar al país

Dada la expresa voluntad política, traducida en una nueva Constitución que. comienza a regir a partir de 1991, y de acuerdo a un nuevo paisaje internacional de las actividades científicas y tecnológicas, fuertemente impulsadas por los desarrollos de las comunicaciones, particularmente la generalización del uso de Internet, los investigadores colombianos crean una asociación ley 1901, la ACASTC [6].

Para integrar los científicos, la asociación se dota de un medio eficaz y particularmente útil en la consolidación de una asociación : el correo electrónico. Además, la idea es aprovechar el medio francés, luego el recurso mas interesante en el momento es el MINITEL, producto tecnológico típicamente francés y de alto rendimiento técnico en relación a su costo de utilización.

La creación de la red electrónica es apoyada por COLCIENCIAS y gracias a el interés del CERMA [7] y los informativos colombianos trabajando allí se instala una red electrónica que va a permitir un cubrimiento amplio en la comunicación de los científicos colombianos en Francia, y con sus pares nacionales en Colombia.

De otra parte, el gobierno francés, a través del Ministerio de Relaciones exteriores, se interesa en el proyecto colombiano y decide entrar a colaborar para el financiamiento de funcionamiento de la ACASTC. la creación de un Plan Nacional de Ciencia y Tecnología, un plan de financiamiento proveniente del BID, una reestructuración administrativa importante al interior de COLCIENCIAS, una voluntad política gubernamental y de parte de los científicos colombianos en el exterior, son probablemente, algunas de las razones que rápidamente impulsaron la creación de otros nodos de científicos colombianos en 22 países del mundo. Dadas las relaciones particularmente estrechas entre científicos colombianos y franceses, con antecedentes históricos significativos que van desde los enormes esfuerzos individuales e institucionales hasta los acuerdos de cooperación intergubernamentales, pasando por enormes tareas culturales, la consolidación de la ACASTC se hace relativamente rápido, gracias a iniciativas anteriores pero que en general quedaban a nivel muy reducido de dos o tres instituciones universitarias y a los enormes esfuerzos de los especialistas franceses en Colombia.

La estrategia de hacer visible los esfuerzos de las actividades en ciencia y tecnología nacionales buscando la cooperación internacional, comienza a traducirse en actos internacionales que permiten el encuentro de los científicos nacionales con sus pares franceses.

Así, en 1993, la ACASTC organiza con el concurso de la Delegación Colombiana ante la UNESCO y la Embajada de Colombia en Francia, « Colombie : carrefour de l'avenir. Premier Forum scientifique en France » [8]. Este encuentro de científicos franceses y colombianos apoyados por los representantes del gobierno, permite que la ACASTC inicie una presencia a nivel de los medios científicos de la comunidad francesa, presencia que será consolidada en la primavera de 1994 con el primer Coloquio Franco-Colombiano de Ciencias Sociales, ENLACES [9].

La iniciativa colombiana no se queda sin embargo, en el marco de la promoción de las actividades científicas nacionales. En el contexto de la comunidad científica internacional y con los nuevos parámetros de cooperación, particularmente impulsados a partir de la Unión Europea con varios programas orientados hacia América Latina, la ACASTC comienza a explorar las posibilidades que ofrece la cooperación biregional entre América latina y la Unión Europea.

Gracias a una gran mobilidad y a una multidisciplinaridad creciente, la asociación comienza a buscar el apoyo de otras asociaciones latinoamericanas de científicos residentes en Francia creadas desde principios de los anos 80.Es así como dada una convergencia de objetivos y una confluencia de acciones el encuentro con otras redes de científicos latinoamericanos es el resultado una estrategia que busca internacionalizar la ciencia y la tecnología en Colombia.

Se acuerda entonces, con el grupo de Científicos Latinoamericanos y del Caribe residentes en los países desarrollados y agrupados en ALAS, Association Latinoamericaines de Scientifiques, asociados con la ACAL, Academia de Ciencias de América Latina, con el auspicio del Comité de Ciencia y Tecnología para los países en desarrollo (COSTED), del Consejo Internacional de Uniones Científicas (ICSU) y el patrocinio de la UNESCO a través de su oficina Regional para Ciencia y Tecnología (ORCYT), Montevideo, impulsar la creación de la Red InterRegional de Científicos Latinoamericanos y del Caribe, para explorar el potencial adquirido por los científicos latinoamericanos en el exterior [10].

Apoyándose en un forum de discusión electrónico sobre « Las redes de la Ciencia : las migraciones científicas internacionales y las redes de científicos latinoamericanos en el exterior » la red InterRegional organiza una Mesa redonda en la sede de la UNESCO, a París el 21 de Mayo de 1996 [11].

Estas actividades permiten ampliar el espacio de las relaciones de los científicos latinoamericanos residentes en Francia interesados en la investigación en cooperación con sus paises de origen, apoyados por los investigadores franceses especializados en América latina.

Además, la consolidación de una base de datos de los científicos latinoamericanos en el exterior comienza a establecer plataformas que, a través de programas y proyectos puntuales en cooperación científica, reorientan el potencial científico y tecnológico desarrollado por los investigadores latinoamericanos y del Caribe en el exterior. La importancia creciente de los investigadores y científicos latinoamericanos en el exterior comienza a evidenciarse con los soportes creados a nivel nacional en las universidades latinoamericanas. El impulso de la regionalización científica a través de redes electrónicas [12] del intercambio del conocimiento y en la búsqueda de proyectos de cooperación apoyados por entes regionales como el CRESAL (Comisión Regional de la Educación Superior para América Latina) y los grupos de universidades del sur.

La generalización de las redes de Internet en los paises latinoamericanos da un gran impulso a la comunicación y a pesar de obstáculos técnicos evidentes, la extensión de Internet continua avanzando. con diferentes propuestas de tecnologías alternativas y tecnicamente eficaces tales como el Sistema Operacional Linux [13], propuestas que comienzan a mostrar alternativas reales con costos accesibles a los organismos laboratorios y universidades de provincia de modestas asignaciones presupuestales. De otra parte, las iniciativas regionales encuentran refuerzos con la constitución de Oficinas de Relaciones Internacionales-ORI, que se plantean como cabezas de puente entre las instituciones y sus pares nacionales en el exterior. Las propuestas de la Unión Europea a través de los programas orientados a promover las relaciones científicas, tecnológicas, comerciales, industriales y culturales, están a su vez reforzando las relaciones interregionales y de acuerdo a las evaluaciones oficiales, la recepción de las estrategias de acercamiento ha sido todo un éxito, tanto que ha impulsado otra serie de propuestas que se traducen en programas como por ejemplo, URB-AL, un programa orientado a estimular el intercambio Europa-América Latina a nivel de las ciudades [14].

Conclusiones

Como se ha podido constatar someramente, existe una tradición muy enraizada que ha estimulado las relaciones culturales, científicas y tecnológicas entre Europa y la América Latina. Las relaciones personales, profundas y de vieja data entre los científicos, han jugado en mucho en los principios de la institucionalización de los intercambios de cooperación entre las regiones europea y latinoamericana.

Francia siendo pionera de dichos intercambios, continúa siendo un actor central en las relaciones científicas con las comunidades latinoamericanas y son las Comisiones Mixtas -con reuniones cada vez mas regularizadas- las que marcan el paso de la cooperación. Actualmente existe un potencial científico y tecnológico que ha comenzado a ser identificado y explorado por parte de la comunidad científica latinoamericana. El reforzamiento de las redes de científicos instalados en Europa comienza a generar beneficios significativos, productos directos del intercambio y del potencial desarrollado por los investigadores latinoamericanos residentes en el exterior.

Es así como, gracias a las iniciativas de las asociaciones de científicos latinoamericanos y de sus pares europeos, una estrategia de acercamiento a través de programas y proyectos de la investigación científica en cooperación ha comenzado a impulsarse, permitiendo además que los diseños de políticas en Ciencia y Tecnología tomen en cuenta los grupos en el exterior.

Igualmente, la Unión Europea ha creado una serie de programas de cooperación, ALFA, AL-INVEST, URB-AL, etc, que buscan un acercamiento interregional mas dinámico y marcado esencialmente por relaciones inter-universitarias, industriales, comerciales y estimulo de las relaciones intra-regionales.

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[12] Ver anexo adjunto con un directorio de direcciones electronicas en algunas universidades de America Latina.

[13] Desde 1994, la ACASTC lanzo una propuesta a las universidades colombianas de implementar el Sistema Operacional Linux. La Universidad del Valle acepto y ambas constituyeron el Centro Linux de la Universidad del Valle. De otra parte, un programa de generalizacion de Linux a nivel nacional esta siendo impulsado por las universidades en provincia con el apoyo de RedCol

[14] URB-AL, es un programa de cooperacion decentralizada de la ComisionEuropea, decidido en diciembre/95, orientado a todas las municipalidades, regiones y otras instancias representativas de colectividades locales yterritoriales de la Comunidad Europea y de America Latina.

Brain Drain: Problem of Contract Migration in Russia

Tatyana Kouznetsova

The peculiarities of international cooperation of Russia in R & D sphere cannot be investigated out of general problems of external migration of scientists and specialists (including outflow of those leaving for permanent residence, for contract-based employment, training, long-term business trip, etc.). Contract-based migration of scientists is one of the basic forms of the international contacts. It witnesses that international labor division process in the sphere of science & technology got more profound. At the same time in Russia this process turns into quite controversial forms.

Emigration of scientists or their long-term work abroad has not still become a form of normal scientific exchange, retaining all the characteristics of the one way " brain drain " - the problem of many developing countries and countries of transitional economy. In this case the discourses about Russian scientists making the world science more rich are just partly valid.

The internal migration of scientists in the hope of a better life and professional growth appears to be the visible element of the Russian situation during the last years. In general the reference to this problem is associated with the troubles in R & D sphere. The outflow of highly-qualified personnel directly affects national interests of Russia, its military, economical and technological security.

With regard to this tendency, the world community also shows some anxiety. The former forecasts (made in the late 80s) of great scale emigration outflows and the emigration of military (especially " nuclear ") specialists to the countries with unstable political regimes are at the basis of this anxiety.

The analysis of the statistical data and expert estimates of scientists migration intentions show that those forecasts have not proved to be correct and the process itself is stabilizing.

Scientific workers share is not large in the total amount of emigrants - 1 % in average. If this category is enlarged so as to include emigrants of the teaching staff (higher education), engineers, heads of enterprises and students, then science intensity of emigration flows from Russia will in some countries exceed 20 %. This displays the sufficiently high quality of emigration from Russia. In general share of higher educated people emigrated from Russia is equal to 20 %.

With the main stream of emigrants departing to Germany, Israel, Greece and USA (mostly as ethnic emigrants), the most " scientific " of these streams are departing to USA and Israel. According to our data, the most " educated " (persons with higher education share in the total amount of emigrants from Russia to this country) of the streams of emigrants is that to Austria (60 %), France (52 %), USA (48 %.) and Canada (40 %).

The territorial structure of external intellectual migration in Russia shows great variation and depends on the level of development and scientific specialization of different regions. The most intensive exodus abroad is observed in Central (Moscow), Northwestern (St.-Petersburg) and West-Siberian (Novosibirsk, Tomsk) regions.

The motives for scientists emigration is determined by a complex of " background " (economical and political instability, uncertainty of the near future, reducing of the standard of living, low social status of science, inclaiming of scientific results and lack of perspective) and " professional " (lack of interesting work, bad conditions for professional activity, intention to rea-

lize scientific ideas and to integrate into the word scientific community) factors. Economical and political instability and inclaiming of scientific results were on the first place among all these factors in 1989-91. The situation has changed later and income level (and the standard of living in general) establishes itself firmly at the first place among the motives for migration.

Emigration becomes more preferable and even easier than any migration within Russia in a search for worth and high remunerated jobs. Thus, the main factors stimulating scientists to leave abroad coincide with factors " pumping them out " the scientific activity. For all this, leaving for different commercial, production, administrative and other structures is more massive. Material component is also important for scientists leaving abroad for contract work. At the same time, the last years have added some new " shades " to this process.

The inquiry into scientific institutes with considerable emigration potential showed that their authorities were estimating emigration processes with restrain. Underlining the importance of this problem for Russia (especially for the retaining of scientific schools) and the damage that emigration of separate scientists makes to the concrete research fields they point the following essential facts : predominance of emigration owing to " family affairs " not to professional ones, weak university graduates inflow to institutes sets the problem of scientific succession more sharply, preference of the contract employment to the straight emigration, appearance of the new self-realization opportunities in scientific institutes of Russia, aspiration of scientists who work abroad for retaining contacts with Russian institutes, - considerably larger damage made to science by internal migration and " erosion " of scientific activity caused by insufficient state support to science, privatization and other processes taking place in the R & D sphere in Russia.

However, the facts of the migration flows stabilization listed above do not give any reason for optimism. Since living standards in Russia do not fit with western standards for yet a pretty long time, some part of scientists (especially young ones) who are capable of selling their knowledge on a foreign labor market will make active efforts for emigration.

Along with " pumping out " factors some restraining factors are valid. Among them there are : the. " immigration capacity " of western countries ; the uncertainty of getting a job in the future, the inequity of qualification standards, the usual conditions of research activities, the arrangement of scientific work ; the dissatisfaction of the conditions and terms of contracts and other factors.

The expansion of contacts itself, the large volume of information about living and working conditions in foreign countries that scientists have, make their approach towards the problem of getting a job abroad more weighted.

The problem of " brain drain " within the process of international contacts expansion should be solved by Russia's own forces. But we may count on interest and understanding of the international scientific community when solving it. Western states, international organizations, national scientific communities and individual scientists are anxious about one of the largest world scientific systems destruction. So they see stimulation of the " personal " migration, provision of conditions for the full-value work of Russian scientists in western laboratories as possible ways of Russian scientists return to the world science. Nowadays all the economically developed countries which are interested in the personnel of Russian science conduct a purposeful immigration policy. An indisputable interest in Russian scientists and specialists is shown by developing and new industrial countries. These countries work out programs of Russian scientific immigrants employment, as suffering " brain drain " themselves.

Another way - is the support of R & D activities in scientific organizations of Russia. This widely advertised abroad approach finds support of scientific communities and state organizations of Russia.

But it should be noticed that the support of science in Russia is very limited. Conditions of the contracts of this kind are estimated by the Russian side as insufficient, especially concerning the items of remuneration. Some surveys show that even the managers of large scientific organizations having contacts with foreign partners, point out that conditions of these contracts had become worse.

At the same time, state structures of many western countries are anxious about the problems coming along the emigration from the former USSR (competition enforcement, introduction of different cultural values, etc.).

Thus, despite the desire of many scientists to leave abroad (forever or for contract work) only a small minority of them is able to achieve this goal retaining themselves within science. This minority, in fact makes up the main and the most important component of " brain drain ".

Some emigrants are forced to change their sphere of professional activity when leaving, in this case Russia looses a scientist and the host country gets a potential unemployed. Another part of emigrants lowers its status. In this case losses of Russia are not compensated by the " acquisition " for the world science which has been widely discussed at the beginning of the 90-s.

The purpose of this research is the determination of the objective parameters, which characterize international contacts of institutes and scientists. The report presents some results of inquests of heads and staff members of academic institutes and of state scientific centers in Russia. Inquests involve scientists who worked abroad and took up research within international projects. Results of the sociological inquests witness the enforcement of Russian scientists aspiration for contract work. Fifty two percent of questioned RAS scientists made the material side of their life improve " owing to the hard currency earned abroad ".

Estimates of opportunities that work abroad provides to scientists are given in table 1. Opinions of scientists working for contracts include more considerations of professional opportunities knowledge application, access to information and to material & technical base, professional contacts and even working climate- than opinions of those who migrate on a permanent basis.

The additional motivations are more independence and self-dependence and understanding of the importance of integration into a scientific community,

Name, references, institute status, projects reputation, participation in the international events, these and other factors determine both nowadays professional and material opportunities of effective professional career promotion in the future.

Geography of the RAS scientists foreign visits and work abroad comprises over 30 countries and 150 cities. The major part of scientists worked in Germany, USA, France and Italy. 50.8 % of respondents worked in universities, 14.6 % in scientific centers, 22.7 % in institutes.

Most scientists left under invitations of foreign organisations (49.2 %) and under personal incentive (20.3 %). 26.6 % of scientists worked within agreements between institutes.

Conditions of sending on business and leaving on personal incentive are of a great importance for understanding the conditions of international contacts of scientists and their influence on the possibility of the contract migration transfomation into permanent one or re-emigration.

Table 1. Expected opportunities that work in foreign scientific organizations can provide to scientists (% relation to the amount of respondents who marked these opportunities with 4 or 5, when 5 is maximum)

More complete realization of knowledge, skills	- 87 (75)
Work with competent colleagues	- 74 (58)
Opportunity to make a contribution to the development of science in your branch	- 78 (74)
Work with qualified managers	- 38 (46)
Benevolent psychological climate	- 70 (74)
Rate of salary appropriate to qualification	- 78 (60)
Scientific contacts with specialists	- 76 (80)
Good material & technical base for research	- 90 (90)
Access to scientific information	- 89 (84)
Work on problems important for the revival of Russia	- 40 (32)
Training and development	- 71 (67)

Note: Estimates of real opportunities are given in brackets.

Almost all respondents retained their position in regular staff list of an institute. There are different ways of solving the problem of salary retaining for employees working abroad. 23.3 % of employees sent on business retain 100 % salary, 33.3 %, 50 %, 42.8 % had no salary retained. Most respondents consider these conditions appropriate. Agreement between organization and employees is one of the most important characteristics of any job. Half of the respondents worked with no documentary registered written agreement, contract, which surely made their living and working conditions abroad worse, and witnessed the absence of the contract work experience. Concerning the remuneration conditions, up to 45.3 %, of respondents consider that their earnings were equal to the remuneration of workers of the same official status. At first sight, this result does not correspond to the opinion widely spread within scientific circles that Russian scientists get considerably " underpaid " signing the contracts for the work abroad. However, at this point, the following factors are to be taken into account : answering these questions, scientists compared the rate of their salary abroad to their salary in Russia. Moreover, even considering this factor, nearly 37 % of scientists estimate their income as not corresponding neither to values and quality of work nor to their skills. Analysis of the full pattern of answers and interviews with separate scientists and managers shows that the majority of them was mainly not satisfied with their labor remuneration abroad.

Presence or absence of conflict situations, their sources and ways of solution is one of the most important characteristics of the living and working conditions of a scientist. The more so, as most respondents considered good working psychological climate as one of the motives for working abroad According to the inquiry, only 12 % of respondents faced conflict situations. Financial problems, restrictions for extra-time work, unusual research arrangements were reasons for those conflict situations.

In spite of the conflict character, all of them, as respondents testify, were solved by discussions and negotiations. But we can suppose that many respondents held back the collision of interests and dissatisfied professional ambitions.

The attitude toward the working conditions abroad is mainly formed under the influence of the difficulties the scientists suffer by being in unusual situation. Thus language barrier (34.9 %) ; new devices and technical equipment (16 %) ; difference in scientific approaches (11 %), dissociation (11 %) ; difference in cultural environment (7 %) are mentioned most often.

The given list display how complex and different are the conditions of possible Russian scientists work abroad. Most scientists point the absence of conflict situations and, at the same time, dissociation and absence of contacts as one of the main obstacles that scientists face abroad.

Opportunity, to apply new facilities and equipment is called one of the professional reasons that induced scientists to contract emigration. At the same time, 11 % of scientists faced difficulties applying new facilities, 16 % applying new approaches. Problem of the intellectual property protection is of major importance for all aspects of international cooperation. First of all, the fact, that actually, the majority of scientists ignore the problem of their rights, grasps the attention (see table 2).

The interpretation is easy and hard at once : the sense of ownership in intellectual sphere had been suppressed within the Soviet reality. Lack of knowledge of laws and of practice of the

Table 2. Estimation of the intellectual product protection conditions (147 respondents total)

Amount	% relation to total
Yes	30.6 (45)
Partly	8.8 (13)
This problem hadn'texisted for me	47.6 (70)
Find it hard to answer	9.5 (14)

contract working out and even light-minded attitude to this should be added. Although scientific organizations and juridical services try to patent many of them cannot pay for that. If patent services (consisting of 1-2 men) are more or less supported in large institutes than lawyer in institute works for just several hours a week. No one even dreams of a lawyer with international experience. It should be mentioned here that not even a simplest document is signed by western firms or specialists without the detailed consulting with juridical services. Anyway, Russian scientists have a lot to learn from their foreign colleagues, who have been trained and are functioning within the conditions of the world information market. In the Russian reality we must teach our scientists the sufficient value of knowledge, arrange the propaganda of the foreign experience in this sphere through the system of scientific periodicals.

In these conditions the fact that 40 % of the respondents consider that their work abroad is profitable mainly for foreign partners becomes not astonishing.

Intensity of respondents connections with their institutes is the important factor forming scientists' attitude to the work abroad. This is a very important characteristic that features temporary migration and defines the efficiency rate of scientific contacts.

According to the inquiry, abroad research subjects of the majority of the respondents (75.8 %) were much linked to the problems of the institutes they had worked for before leaving, though in many cases it had been defined in foreign laboratories. About 70 % of the respondents have informed their institute of their work somehow. The overwhelming majority of them remarked in their publications that they belong to Russian institutes. According to the inquiry, arguments of foreign entities against this were very exceptional.

Despite obvious problems, most Russian scientists would like to remain " faithful " to their professional career. Most respondents gave a positive answer to the question on the close prospects of work in Russian institutes.

These estimates are pretty astonishing as considering all the well-know facts of the Russian reality. Opinions of the heads of the state scientific centers will allow to estimate this " phenomenon ". Many of them point out the following : 2-3 years ago work abroad was undoubtedly the most profitable alternative. Nowadays, in spite of the continuing crisis in science and all the remaining advantages of the contract work, some opportunities of the new essence have got to exist in the R & D sphere in Russia. They will allow scientists to make good earnings at home.

It is important for scientists to estimate the possibilities of retaining their status and rate of salary when making the decision to work abroad. For all this, those who have left, almost always gain higher salary rates, but only a few of them manage to retain their status.

The research conducted does not allow to appraise all the questions of the Russian scientists international cooperation. Only a definite part of the Russian scientific community -scientists and heads of academic institutes and heads of the state scientific centers - was set as the object of analysis. As these very sectors of Russian science are much involved in international relations, the results obtained, however, are of some interest for analysis of the general problems appearing in this sphere, by our opinion.

Modern development of the world science and processes taking place in Russia will surely reflect on the state of its international relations. On the one hand, the value and quality of its scientific potential does not allow Russia to stay away from the solution of the global problems of economical and scientific & technical development. On the other hand, - under the pressure of the local problems, Russia is not only loosing its scientific potential but also weakening its positions in the world science and loosing advantage of its integration into the world scientific process. In particular, migration of scientists (including contract migration) lowers the " critical mass " necessary for balancing scientific and production potentials of Russia in general and of potential concrete organizations.

In spite of Russian authorities and foreign states representatives assurances that scientific contacts with Russia must be formed only on the basis of mutual profit, there is an international support of the Russian science achievements realized on one hand, while a one-sided utilization of its scientific and technical achievements and personnel potential is taking place on another one.

Today, the situation of development in Russian science has two speeds. Some scientific collectives and individual scientists try to adapt to the new conditions using foreign aid, international contacts and local alternative sources of financing. Others, in conditions of poor inner financing, do not have the opportunity (or skills) to obtain the foreign aid or use the international cooperation opportunities in some other ways. The current situations in these two groups defer considerably. But they also have something common - the future depends on the revival of the Russian economy and of political stabilization.

Despite obvious problems, many scientists are not going to give up their scientific career, or to combine it with some other activity, and do not plan to leave science for commercial structures

A work abroad remains one of the most attractive directions of professional activity : it is the orientation of 63 % of the Russian Academic of Science workers. Some institutes have 85 % of scientists preferring to receive grants and contracts to work- on the basis of them.

Working abroad gives scientists undeniable advantages. Among them the material advantage plays an “honored” but far from the only, important role. Conducting a research on a good material and technical basis, the possibility to apply the brand new scientific information are not of the least importance for scientists. A considerable addition to the pointed list are motives of more independence and self-dependence as well as higher opportunity of grant reception in Russia and abroad. Approximately 80 % of Russian scientists published the results of their studies abroad in prestigious foreign magazines. Working abroad make scientists more informationally rich, helps further broadening of the international contacts. However, because of some well-know obstacles, foreign publications - inaccessible to the majority of Russian scientists - fall out of national scientific turnover, making home research poorer. Russian institutes do not track foreign publications of their workers, do not conduct any analysis of them. Indifference of the majority of respondents concerning the protection of rights to the scientific product they created is a serious preoccupation.

According to the respondents, it would be expedient for international contacts development to establish - under the experience of many foreign countries - professional associations of expatriate Russian scientists supported by the state institutes. These associations may be useful either for scientists themselves (58.6 % of positive answers) and for Russian science (52.6 %), and should make their contribution to creation of premises for the Russian scientists repatriation. These associations are able to help Russian scientists to adapt better for working and living conditions abroad, including their rights protection.

At our point of view, it is necessary to create Russian professional associations abroad involving straight participation of the state organs.

Foreign experience shows that realization of this measure will help to unite not only temporary Russian migrants but our former compatriots either, and will also create some prerequisites for re-emigration.

Analysis and generalizing of the inquiry results display that to the interest of the further international contacts development, allaying the problems of brain drain and solution of other problems, arising the international cooperation, it is necessary to clarify the understanding of structure, trends and specificities of the scientific personnel flows in Russia.

Expansion of scales and modernization of forms of the international relations is the source of migration flows regulation. It prevents from the non-controlled spread of scientific &- technical activity result, promotes the foreign capital attraction to Russia. All this positively influence the securing of scientific and technical personnel within the country.

However scales of Russian scientists emigration are connected with a complex of reasons, the short-term overcoming of which is not possible, and which require the state regulation; for example within the interdepartmental program of regulation of the scientific & technical personnel migration. Legislative securing of the organizational legal base of the emigration flows regulation means acknowledgment of this process as the objective factor of international life and allows to introduce it to normal civilized limits.

1. Some experts estimate the share of R & D-engaged specialists (including scientists, auxiliary personnel and some other categories)- number of employees of the sector " Science and Scientific Services " in Russian official statistics - in the total amount of emigrants equal to 2 % (or about 2 thousands in 1994). These estimates are calculated on the basis of industrial distribution of all employees and seems too be overstated for us.

2. Inquiries display that 7 % of students of the metropolitan universities already have concrete proposals from foreign firms (in some universities, for example MPTI, this rate shares the major part).

3. By the estimations of specialists of the Ministry of science the scientific personnel outflow to these structures is nowadays approximately 10 times bigger than leaving abroad. Due to the estimations of the specialists of the Analytical Center, approximately 5 % of the total reduction in R & D-engaged personnel is their outflow for permanent residence, training and contract-based employment abroad.

4. The inquiry is a part of the large project on mobility of scientific personnel of Russia and carries on series of works on the analysis of the support and development possibilities of the scientific organizations potential conducted by the Analytical center for scientific and industrial policy.

Estimates of the contract emigration are obtained during the inquiry, into the RAS institutes conducted by the group of sociologists under the supervision of D.D. Raikova in 1994. Inquiry comprised 170 scientists from 8 RAS institutes (of biological, physical and chemical profile). Results of inquiries into 40 state scientific centers, conducted by the Analytical center workers in 1995, were also applied.

The Reverse Transfer of Technology from Sub-Saharan Africa: Some Lessons from a Preliminary Assessment of the Zimbabwean Case

Bernard Ikubolajeh Logan

The brain drain is defined broadly to include the systematic high volume emigration of 'Professional, Technical and Kindred' workers. The process, which is typically occupation-selective can occur from any country to another country or group of countries. Logan (1992) has identified four main geographical patterns in this international flow of trained experts : (i) from one developed country to another developed country (as in the case of British nurses to the US during much of the 1980s) ; (ii) from a developed country to a Third World country (usually in the form of technical support as with Americans in Kuwait) although, whether this is actually a brain drain now is debatable ; (iii) from a Third World country to another Third World country (this is typically a regional flow as from many Southern African countries to the Republic of South Africa) but macro-spatial flows are also possible as with Filipinos and other South-east Asian professionals to the Middle-eastern oil rich states) ; and, (iv) from a Third World country to a developed country.

The last of these flows, from the poor South to the opulent North, is sometimes referred to as the reverse transfer of technology (RTT). The term emanates from the fact that technology transfer is normally from a developed country to a Third World country in the form of hard machinery and managerial skills. In the RTT, however, technology transfer in the form of the embedded and embodied expertise of a scientist (rather than in a physical or mechanical form) is from the Third world to the developed world.

There are two shortcoming with present approaches to the RTT ; one deals with data aggregation and accessibility, the other with lines of analysis. The data problem stems from a widespread assumption that immigration records compiled in the West are comprehensive enough to provide answers to the several dimensions of the RTT. Clearly, this is not the case. For example, US immigration records might indicate that Ghanian medical doctors constitute a small percentage of all medical doctors immigrating into the US in a particular year. However, these data cannot provide insights into the actual loss of these experts to the Ghanian health sector, nor can they explain why the doctors decided to emigrate in the first place.

The second problem with present approaches to the RTT is the underlying assumption that it is caused exclusively, or almost so, by economic forces. While this assumption might well be correct, it is based on intuitive judgement rather than on empirical validation of a diverse array of factors. It must be recognized that source (home country) conditions are dynamic and have spatial and temporal variants ; the population of skilled experts is not monolithic ; and, most importantly, their decision-making process is likely to constitute an 'untidy' combination of social, cultural, economic and personal variables. For these reasons, it is necessary to explore whether economic forces, by themselves, constitute a satisfactory and sufficient explanation of the RTT.

Amongst other things, the present study is an attempt to redress these two shortcomings in pre-

sent RTT analysis. The study focuses on the RTT from Africa, and tries to utilize data from Zimbabwe to provide insights on the conditions at home that have a potential to force African experts to emigrate. The general problem addressed in the study may be formalized into the following four specific questions.

1. What are the general trends of the RTT from sub-Saharan Africa ?
2. Is it possible, for policy purposes, to differentiate between experts who are likely to emigrate in the near future and those who are not ?
3. If it is possible to separate these two groups of experts, what demographic and other explanatory attributes are likely to be useful in this exercise ?
4. What actual and perceived factors at the source impel experts to make the decision to emigrate and upon what actual and perceived conditions overseas do they construct their destination choices ?

All of these questions, especially the last three, are closely related. A primary objective of the study, therefore, is to verify the importance of economic motives in the decision to emigrate. However, the study is also an attempt to venture beyond economic explanations to contemplate upon, and understand the influence on non-economic factors in the decision-making of experts. In this sense, the answers to the questions formalized above, may have significant policy implications. If it is possible to distinguish between experts who are likely emigrate and those who are not, policy mechanisms could be implemented to introduce conditions that will reinforce the decision of experts who are predisposed to stay home, and to convince those who now desire to emigrate to stay and contribute to the domestic economy.

Contextual background

Academic interest in the RTT

The RTT was a major research and policy question during the 1970s when Third World countries, including those in Africa, were striving to establish the human and other infrastructural capacities for ‘take-off’. During the 1980s, other immediate economic imperatives, for example, commodity price fluctuations, structural adjustment, population growth and political reform, replaced the RTT as urged development questions. In the 1990s, however, the RTT has reemerged at the center stage of development discourse. This renewed interest is evidenced by a recent spate of research output on the subject, for example, Gonzalez (1992) on the Philippines ; and Chang and Deng (1992) on China. Other recent studies of the RTT cover South Korea, Hong Kong, Singapore, the Caribbean, and Eastern Europe.

The new RTT literature has broken ground on a number of issues that were not part of the earlier discourse on the subject. One of these new areas of interest is the spontaneous process of ‘brain gain’ now being experienced by middle income countries in Asia, and even some in Africa (especially South Africa, Botswana and Eritrea). Intuitively, it would seem that the ‘brain gain’ is the converse of the brain drain and that the former is a sufficient solution to the latter. This benign view of the brain gain has led to policy apathy. The general view seems to be that there is no need for government action to understand why and how indigenous experts make the decision to return home and what impacts their return has on the domestic economy. However, it is becoming clear, in Southern Africa, for example, that the ‘brain gain’ is not simply an answer to the brain drain. It comes with its own set of unanticipated difficulties which may need policy attention. For example, at the labor market level, there is often a mismatch between demand and the supply provided by returning experts, and at the social relations level, there is

often negative competition between returning experts and those who had stayed home (usually resentment from the latter). An equally important difficulty is that economic prosperity breeds its own unique circumstances, principal amongst which is the fact that middle income countries become potential estimations in the RTT. Thus, with opulence, the status of middle countries changes dramatically from net losers to net gainers in the RTT. This change in status necessitates that middle income countries must explore strategies to utilize the influx of indigenous and foreign experts in the most efficacious way towards their development objectives.

The recent literature on the RTT also touches on institutional mechanisms to entice Third World experts to return home. The International Office for Migration (IOM) and the UNDP's Transfer of Knowledge Through Expatriate Nationals are two cases in point. While the former seeks to return experts to their home countries on a more permanent basis (IOM, 1992), the latter sponsors the repatriation of experts through government channels, for specific time periods, on specific projects in their home countries. The advantages of the TOKTEN approach are : it is built on 'cultural affinity' (experts are sent only to their home countries), it is on a volunteer basis, and it allows experts to contribute to the development of their home countries without forcing them to make difficult choices concerning change of life style, legal residency, and citizenship (Logan, 1990). Both IOM and TOKTEN hold much promise for solving human resource scarcities in Third World economies, especially as both programs operate largely at the public sector level where national labor needs can be targeted more effectively that in the private sector.

At least two global conditions seem also to particularize the present renewal of interest in the RTT. First, there is concern in Europe over the recent massive entry of East European scientists into the region's labor market. The economic, social and political implications of this process have yet to be addressed directly as the EU solidifies its regional economic leadership while the former East Bloc countries experiment with democracy and free market enterprise.

A second global trend that has resurrected the policy significance of the RTT is its undeniable socioeconomic and cultural impact on the poorest countries of Africa and Asia. These factors, especially the large and persistent hemorrhaging of managerial and scientific skills, have always been in existence. However, they have become more pernicious towards the turn of the century. It is now clear that three decades of post-independence investments in human resource development have not borne fruit. Quite to the contrary, a case can be made that there have actually been an inverse relationship between investment in human resource development and industrial, scientific or economic progress in many parts of Africa and Asia. As these regions, especially Africa, become further marginalized in the international economic, scientific and intellectual realms, policy makers are being forced to reassess their manpower planning strategies of the 1970s and 1980s, and to seek answers to the problem rather than continue to react to immigration policies in the West. The search for solutions must incorporate long term strategies to place education at center of economic and political reform packages rather than at the periphery where it now resides. The search for solutions must also include more immediately attainable goals, for example, hiring indigenous rather than foreign experts for national development projects and targeting scholarships and study leaves for specific disciplines which complement development plans. Some of these efforts are already in some countries, but it is clear that their scope needs to be broadened to cope with the increasing complexity of the RTT.

Theoretical studies of the RTT

Theoretical analyses of the RTT have revolved largely around the suitability of neoclassical international trade, international migration and international political economy theories to enlighten the complexities of the international flow of 'brain resources'. Early theoretical studies of the subject (example Bhagwati, 1978) treat the RTT within the framework of interna-

tional labor mobility. Recent reactions are, however, more cautious about applying the optimizing criteria of labor analyses to the nebulous area of 'brain resources'. Adepoju (l991) and Achanfuo-Yeboah (1993), for example, advise caution against placing the cultural and psychological intricacies of the RTT into simple economic optimization frameworks.

Another important theoretical thrust of the RTT concerns its trade and financial implications. Several early studies of the subject have tried to construct taxation, trade, and legal frameworks within which the process can be meaningfully assessed. As Bhagwati (1978) and Pomp and Oldman (1978) have pointed out, many of these approaches are fraught with both theoretical and practical limitations. In particular, taxation or financial repatriation strategies must be capable of conceptualizing the benefits and costs of the RTT at both the source and destination. Is it clear, for example, that the benefits lost to the source country, however it may be quantified, are equal to the benefits gained by the destination country ? Are the actual and opportunity costs, if any, at the source, borne by governments alone, or by a combination of private and public entities. If the latter, how can the benefits of the process be apportioned and allocated to reflect these different cost constituents ?

One theoretical possibility for resolving the problem of equitable allocations of costs and benefits was proposed by Oldman and Pomp (1978). They couch the RTT under the broad aegis of international capital flows, and handle it as a special case of international taxation. Their approach makes it possible to treat the RTT simply as a matter of income transfers between countries : experts could be taxed in their countries of residence and the funds could be transferred to their home countries as an item in the balance of payments between the two countries.

Other scholars have approached the problem, similarly, as a simple arithmetic issue of capital now accounting using either historic or present discounted value (Bhagwati, 1978 ; Rauch, 1991). The conceptual logic behind this approach rests on the assumption that value can be imputed to the RTT as a form of capital assistance from a Third World country (the home of the expert) to a first world country (the present country of residence of the expert). The earnings of an expert, while in the latter, could be accumulated, and a predetermined portion of the present discounted sum could be included in the transactional balance of payments to the home country.

Unfortunately, these theoretical approaches to the RTT have yet to provide an adequate framework for capturing all of the complex nuances of the process. One serious conceptual difficulty is that the calculus of costs and benefits involves a number of immeasurables, and an equal number of undefined (and undefinable) units of measurement. Four examples will underscore this point. (1) Any attempt to translate the marginal productivity of labor to a universal norm is conceptually risky. Productivity at the margin is likely to be measured differently in different sociocultural settings, and the direct values (monetary and otherwise) associated with such productivity are also likely to be different. (2) Attempts at equating educational costs with discounted productivity are especially problematic because they make questionable assumptions regarding national and personal opportunity costs. They also make very worrisome assumptions about the differential marginal productivity of individuals even when they have similar inculcated skills. (3) It could be argued that when an expert emigrates, the home country bears further opportunity costs only if the individual could have been gainfully employed. If not, it seems that the relief from unemployment that the home country enjoys is a benefit rather than a cost. (4) As mentioned earlier, there is much uncertainty regarding the allocation of educational costs in the training of an expert. As a result, how benefits should be apportioned is also problematic. Educational costs may have been borne in different proportions by the individual (working to support him/herself), the individual's family at home and abroad, the country of residence through an assistantship, and the home government, through a study leave or scholarship. It is improbable that the educational costs can be determined with enough certainty to provide guidance to the amount of reparation that the home government deserves.

The theoretical and conceptual problems that surround the RTT are likely to become more intractable as the process itself becomes more complex in the future. For instance, it is not too far-fetched to assume that strategies for reparation to home governments will soon become complicated by the internet. If experts could work for and be paid by a foreign firm without ever leaving the home country, then they could easily be taxed by the home government. This would essentially render the issue of reparation of funds a moot one. Developments like these, especially in the communications industry, make it unclear at this time, whether theory will guide policy or whether policy innovations will set the groundwork for a theory that is likely to incorporate elements of international labor and international trade paradigms.

Empirical studies of the RTT

Empirical studies of the RTT may be divided into two categories : those that examine the process from a global perspective, and those that are national or regional in scale. Global studies of the RTT are rather dated. In general, they are based on interviews of Third World experts resident in developed countries, and they attempt to determine why these experts have decided not to return home (Glaser, 1973 ; Friborg, 1975).

National and regional studies of the RTT are as dated as the global ones. Many of these micro-scale studies can be traced back to the mid to late 1970s when the United Nations Conference of Trade and Development (UNCTAD) sponsored a number of brain drain projects. A significant number of these UNCTAD studies cover countries in Asia, especially India, Pakistan and the Philippines (UNCTAD, 1978a, 1978b, 1978c, 1978d ; Oh, 1977 ; Nasseem, 1978 ; Sicat, 1978 ; and Tangeman, 1989).

Few empirical studies of the RTT have been directed at Africa (Russell, 1985 ; Achanfuo-Yeboah, 1993). US immigration data have been used to investigate the RTT from Africa, in general, and sub-Saharan Africa in particular, first for a period covering 1974-1984 (Logan, 1987) and then for a second period covering 1980-1989 (Logan, 1992). These studies have determined that sub-Saharan countries ‘exporting’ large numbers of experts to the US share certain similarities in population size, official language, colonial tradition, and history of higher education. Generalizing from the US data, the studies also conclude that a combination of factors favor the mass exodus of experts from a source country : a large population (countries like Nigeria and Kenya with large populations are also major actors in the process) ; a pro-Western political ideology (in fact, experts from Marxist countries are often classified as refugees, thereby excluding them from any accounting of the brain drain) ; and, sociopolitical and cultural links with the metropolitan countries which once colonized the source country. Other related factors found to be relevant include the international language used as an official language, and the language of higher education at the source and destination. The relative importance of these different factors has yet to be determined by empirical analysis.

The RTT from sub-Saharan Africa

Worsening economic conditions in many African countries during much of the eighties have had a number of interrelated impacts on higher education, one of them being a general retrenchment of government expenditure on secondary and tertiary education. For example, per capita public educational investment in Ghana has dropped from US $20 in 1972, to US $10 in 1979, to as little as US $1 in 1988 (Asobayire, 1988). This trend has the cumulative effect

of reducing academic and professional opportunities for indigenous experts. Economic austerity has also forced governments to reduce their efforts to recruit their graduates and nationals working abroad. As a result, even those experts who may have wished to return home, are becoming resigned to overseas employment. At the same time, as career opportunities continue to shrink at home, the number of emigrating experts has also increased.

Evaluating the RTT at the destination: African experts to the US

The impacts of socioeconomic pressures on the African RTT are reflected in US immigration data of all Africans entering the US over a ten-year period. The data indicate that between 1980 and 1989, the share of Africans in the total number of immigrants to the US increased from 2.6% to 3% Although this increase is marginal, at best, two salient points also emerge concerning the outflow of African from the continent: (i) Africa has the highest regional growth rate of immigration to the US; (ii) Africa has the largest immigrant: expert ratio of any world region (Logan, 1992). This seems to suggest that, more so than other world regions, African immigrants must be qualified experts to have a likelihood of obtaining a US visa.

Looking specifically at sub-Saharan Africa, the data for 1980-1989 indicate that 'executives and managers' account for 20 % of all immigrants from the sub-region to the US, This figure compares with an average of 8 % for other world regions combined. 'Third Preference' visas and 'executives and managers' together account for 25 % of all sub-Saharan Africans entering the US, compared with only 9 % for other world regions combined. It is not certain that the US trend is replicated in other developed areas. However, it is not too unrealistic to expect that the figures for Western Europe may be even more significant in Europe because of the strong historical, economic and cultural ties between that region and Africa (Logan, 1992).

Evaluating the RTT from the source: The Zimbabwean case

Zimbabwe presents an interesting empirical case to assess the varying source conditions that direct and motivate the key actors in the RTT. The relevance of the Zimbabwe case for other countries in the region rests on its complex colonial history, its strong ties with Europe, especially Britain, its strong present economic performance, its strong presence in the Southern African Development Community (SADC) region, and its emerging economic and political leadership role in the whole continent. Some of these are attributes which are shared by other African countries and others are attributes which place Zimbabwe in a position of example for other African countries.

Since independence in 1980, a number of mitigating strategies have been implemented to redress racial imbalances in education and other human development sectors. One of the pillars of this push is the 'indigenisation' of education. This process has involved sending black Zimbabweans overseas for higher education and giving them leadership positions in government, and in secondary and tertiary education upon their return. Under these circumstances, it is reasonable to expect that qualified Zimbabweans have every incentive to return home upon the completion of their studies, and that those who return home will stay to contribute to the domestic economy.

Not only are there national incentives for Zimbabweans to return and stay home, the country's position in SADC is second only to South Africa's, and Zimbabwe is considered to be one of the emerging economic success stories in Africa. The country is a net exporter of its basic staple, maize, and a major exporter of meat to the European Community and south east Asia. In this sense, Zimbabwe can be considered to be food self-sufficient. These healthy economic

conditions, together with political stability provide additional incentives for Zimbabwean professionals to return and stay home. It is in this context that Zimbabwe can help other African countries determine whether national economic well being is a sufficient condition to reduce the brain drain or whether the decision-making of experts involves other, more complex assortment of factors.

The objective of the Zimbabwean study, as mentioned in section one, is to determine (i) whether there are demographic and social differences between experts who express a desire to emigrate and those who do not ; (ii) whether there are certain factors which direct and underlie the decision of experts to emigrate ; (iii) whether there are any differences between experts who express a desire to emigrate and those who do not, on the basis of a number of factors, including work conditions at home and abroad, economic conditions at home and abroad, and perceptions about the desirability of potential destination countries.

Data and data sources

Data on the factors that underlie the decision of experts to emigrate have been obtained from a questionnaire survey conducted at the University of Zimbabwe, Harare between February and April, 1996 (the survey is actually ongoing and some respondents who did not reply on the first round have to be revisited on a second round). The target population comprises of all born or naturalized Zimbabwean academic staff. This population is about five hundred (500), so it has been decided to conduct a complete census rather than a sample survey. The response rate at the time of drafting this report is 38 % (out of 497 questionnaires distributed, 163 have been returned completed). The response rate is expected to increase to the 50 % mark during the second round.

The survey instrument is designed to eke out a number of questions, including the following : age and marital status, academic discipline, highest qualification, field of specialization, country in which highest qualification was obtained ; language of instruction ; employment status in Zimbabwe ; pay scale ; satisfaction with present job and job environment ; satisfaction with present national economic and political environment ; satisfaction with present family, cultural and social environment ; possibility of emigrating ; reason for emigrating, and potential destination of emigration. The results obtained so far have been collated and analyzed in rough tabular form. This elementary statistical analysis is used to assess, in a rough way, whether it is possible to differentiate between experts who have expressed a desire to emigrate and those who have expressed a desire not to emigrate. As noted earlier, if this is possible, it would have important policy implications. It would be possible to establish a profile of a potential emigre in terms of demographic, social and economic characteristics and to identify the factors which underlie the decision to emigrate. Mitigating policy instruments could then be put in place to minimize the tendency to emigrate.

Preliminary results from the Zimbabwe survey

Socio-demographic profile of respondents

Table 1 is a summary of the demographic and social characteristics of the two groups of experts : those who have expressed a desire to emigrate in the near future (l-3 years) and those who have expressed a desire not to emigrate. The two groups are similar in that they are comprised largely of males (reflecting the gender bias in the academic staff), yet, there are some distinctions in their demographic and social attributes. Those who intend to emigrate are largely in their thirties (67 %), while those who do not intend to emigrate are older, sixty percent of them being forty-one years or more. At this level of the analysis, the most noticeable diffe-

Table 1. Demographic and background. Attributes of the two groups of experts

	Intend to emigrate (%) (n=62)	**Do not intend to emigrate (%) (n=101)**
Age		
21-30	-	9
31-40	67	31
41-50	17	38
51+	16	22
Gender		
male	83	75
female	17	25
Marital Status		
single with children	0	12
single without children	0	0
married with children	20	79
married without children	80	9
Education		
BA/BS	16	22
MA/MS	50	47
Doctorate	34	31
Service		
1 year	29	7
1-5 yrs	29	36
6-10yrs	52	36
10+ yrs	0	21
Salary		
low	33	-
medium	67	86
high	-	14

rence between the two groups is that those who intend to emigrate are largely married without children (80 %) while those who do not intend to emigrate are largely married without children (79 %). In fact, ninety-one percent (91 %) of those who intend to emigrate do not have children. It is too early to draw any inferences from these data concerning the impact of child dependents on the decision to emigrate, but there is some suggestion that this factor cannot be totally ignored when a policy framework is being prepared by any African country.

The two groups of scholars cannot be differentiated on the basis of educational qualification (Table 1) but the data indicate that those who intend to emigrate are younger in tenure and, as may be expected, have a less favorable opinion of their salary conditions than their counterparts who do not intend to emigrate. In addition, experts who do not intend to emigrate are to be found mainly in the humanities, business and social sciences (73 %) while those who intend to emigrate tend to be clustered in medicine and engineering (57 %) (Table 2).

In an attempt to create a socio-demographic profile of each group, therefore, one can suggest the following attributes as a first and rough approximation.

(1) An expert with the potential to emigrate in the near future is : 31/40 years, without children (married or single), less than ten years in service, considers his/her salary scale to be low to medium, and is likely to be in medicine or engineering, although he/she may also be in other sciences.
(2) By contrast, an expert who has expressed a desire to stay home is : forty years and older, married with children, five years and over in service (and likely to be more than ten years and over in service), considers his salary scale to be medium to high, and is likely to be in the humanities, social sciences or business.

Although these profiles represent a crude, first approximation, the approach itself has some potential for policy formulation. Even at this elementary level of analysis, the data seems to suggest that age and number of dependents are critical demographic factors in the decision to emigrate or stay home.

Table 2. Academic fields of the two groups of experts

Dont intend to emigrate	**Intend to emigrate**
Administration	Agricultural Engineering
Adult Education	Anaesthetics
Animal Science	
Agronomy	Biochemistry
Archaeology	
Biology	
Business	
	Civil Engineering
	Crop Science
Education	Education
Electrical Eng.	
English Literature	
Hotel/catering	
Linguistics	
	Mechanical Eng.
Mining Eng.	
Political Sc/Admin	
	Pediatrics
	Pharmacy
	Psychology
Public Admin	
Social sciences	
Soil Sciences	
	Urban/Peg. Planning
	Water Eng.
	Medicine
Humanities, Social Sciences and Business = 73%	Medicine and Engineering = 57%

Job-related conditions at the source

The decision of an expert to emigrate is almost certain to emanate from dissatisfaction with work conditions in the home country. The extent to which these factors may be economic, social, or cultural, is still unclear. The Zimbabwe case seems to suggest that a complex interplay of all three groups of factors contribute to the final decision of an expert to emigrate.

The data on Table 3 show that all of the experts who intend to emigrate are dissatisfied with their present job. While this is not particularly surprising, it is surprising that 54 % of those who do not intend to emigrate are also dissatisfied with their present job. If job dissatisfaction is so prevalent, what job-related conditions transform job dissatisfaction to complete alienation for one group (100 % looking for a job) while the other group is more willing to be patient (86 % not looking for a job) ?

The data on Table 3 suggest that the major factors underlying a negative job assessment for both groups are : *low salaries, poor research facilities, poor work ethic of colleagues and supervisors and poor opportunities* for career advancement. For those who intend to emigrate, these are critical factors which score on the 'strongly agree' to 'agree' range on the five-point Likert scale. Those who do not intend to emigrate only 'moderately agree' that these factors constitute a serious drawback to their estimation of their jobs. Economics and the sociocultural environment of the workplace are important to both groups. However, for those who already intend to emigrate, the sociocultural factors have become intolerable, while for those who have decided not to emigrate, these conditions merely need attention and have not yet reached a crisis stage. This fundamental difference in the attitudes of the two groups towards their work environment should also be instructive for policy purposes.

As with the sociodemographic factors in the previous section, more comprehensive analyses are

Table 3. Job-related perceptions of the two groups of experts

	Intend to emigrate (%)	Do not intend to emigrate (%)
Satisfied with present job		
strongly agree	0	0
agree	0	14
moderately agree	0	32
disagree	43	40
strongly disagree	57	14
Factors for negative job ratmg (5 pt Likerts Scale)		
salary	1.0	2.3
career advancement	2.2	2.8
work pressure	2.0	2.6
poor work ethic	1.8	3.3
research facilities	1.5	2.6
Looking for a job?		
yes	100	14
no	0	86
If yes, where are you looking for a job? (5 pt Likert Scale)		
Southern Africa	2.5	3.0
Other Africa	5.0	3.0
US	2.0	5.0
Canada	2.0	5.0
Europe	2.0	4.0
Australia	5.0	5.0

required to determine the relative influence of the different factors which create job dissatisfaction, and the degree to which it contributes to initiating the desire to emigrate. For example, it is not surprising that *poor salaries* and *poor research facilities* are identified as important determining factors by both groups (even though with different emphasis). However, it is a bit more surprising that *work pressure* and the *poor work ethic of supervisors and colleagues* should be scored so highly, especially by those who wish to emigrate. These two factors are scored even more highly than 'opportunities for career advancement' by this group of experts.

It is interesting to note that the geographic range of a possible or ongoing job search is different for the two groups of experts, perhaps, because the factors responsible for their job dissatisfaction and the intensity of their job alienation are also different. Those who intend to emigrate tend to be pulled towards Europe (agree), US (agree) Canada (agree) and South Africa. Those who do not intend to emigrate seem to have a stronger regional pull, with their potential job search restricted to Southern Africa or other African countries (Table 3). One should not draw too much from this result, but it is possible that both groups are generalizing their Zimbabwean experience to the continental level. Those who intend to emigrate expect to find conditions in other African countries to be just as frustrating as they find them to be in Zimbabwe As a result, they are opting to seek jobs in the West, where they expect these conditions to be more conducive to productivity. By contrast, those who do not intend to emigrate expect that conditions in other African countries are as tolerable as they find them to be in Zimbabwe. Consequently, they see no reason to venture far afield to seek jobs, if the need should arise.

The preliminary assessment of the Zimbabwean case indicates that job dissatisfaction emanates primarily from economic forces. This finding supports what has often been assumed in the literature. However, the data also suggest that economics is strongly complemented by the sociology of the work place to create worker dissatisfaction. In particular, experts tend to be frustrated and alienated by what they consider to be the poor attitudes of colleagues and supervisors towards work and productivity. These factors seem to be just as important, if not more so, than research facilities and chances for career advancement, in creating the conditions under which experts decide to emigrate.

The decision to emigrate

As noted earlier, two groups of experts have been distinguished on the basis of their expressed desire either to emigrate or not to emigrate in the near future (defined as 1-3 years). The expressed desires of both groups fall clearly at polar ends of the Likert scale : all of those who desire to emigrate 'strongly agree' or 'agree' with the statement that they are likely to emigrate; while those who do not intend to emigrate cluster at the 'disagree' to 'strongly disagree' end of the scale.

It would seem that when once the decision to emigrate has been made, experts have a distinct group of countries that they identify as potential destinations. The top twelve potential destinations of those who intend to emigrate are ranked on Table 4. It has been noted earlier that this group of experts does not show a distinct regional predilection in their job search area (Table 3). On the contrary, their choice of potential destinations shows a clear bias towards southern Africa. What this suggests is not quite clear. It would seem that experts are willing to look for a job in a country to which they may not be willing to emigrate. In essence, they are not reluctant to cast their nets widely while looking for a job, but when the actual decision to emigrate must be made, they are reluctant to move too far away from the home country.

The choice of potential destination in the emigration process is based substantially on the perception of experts regarding its economic and social conditions. The most important pull factor to a destination are expectations of the existence of high paying jobs (Table 4). Geographic proximity to the home country is also an important factor but, contrary to what one would have expected, educational opportunities for spouse and kids do not seem to exert an important pull effect. This is, perhaps, because so many of those who wish to emigrate do not have children.

While economic conditions and geographic proximity are the most important pull conditions, the push factors in Zimbabwe seem to cover a wider array of considerations (Table 5). The two groups of experts were asked to score factors that would impel them to leave Zimbabwe. Those

Table 4. Decision to emigrate

	Intend to emigrate (%) reponse	**Do not intend to emigrate (%) reponse**
Likely to emigrate in the next 1-3 years?		
strongly agree	34.0	0
agree	66.0	0
moderately agree	0	0
disagree	0	7.0
strongly disagree	0	93.0
Rank your top 12 potential destinations		
	Southern Africa (1) Mozambique (1) South Africa (3) Botswana (3) Britain (4) USA (5) Germany (6) France(7) Italy (8) Canada (9) Australia (9) Namibia (11) Mid-East (12)	
Explain your ranking (5-point Likert scale)		
High salaries	1.5	
Close to home country	2.0	
Best job opportunities	2.5	
Good overall quality of life	2.6	
Educational opportunities for spouse	3.0	
Good educational opportunities for kids	3.0	
Good research facilities	3.3	

who do not intend to emigrate do not have strong feelings on this subject (as to be expected) and 'moderately agree' that economic forces (high cost of living and difficulty of obtaining a high paying job) might act as push factors in Zimbabwe.

Those who intend to emigrate identify high cost of living, difficulty of obtaining a high paying job, and high taxes as the critical factors. These three factors are followed by poor political climate and poor educational opportunities for self and spouse. In the latter instance, it would seem that even though educational facilities at the destination do not necessarily constitute a pull factor, they are considered to be a push factor in Zimbabwe. What this suggests is that experts who wish to emigrate take it for granted that educational opportunities would be available at the destination, and that they would be better than, or equal to what is to be found in Zimbabwe.

Table 5. Conditions in Zimbabwe underlying. Actual/potential decision to emigrate (5 Pt Likert Scale)

	Intend to emigrate (%)	**Do not intend to emigrate (%)**
High cost of living	1.6	2.7
Difficult to obtain high-paying job	1.6	2.7
Poor political climate in country	2.3	3.9
Poor educational Opportunities for spouse	2.4	4.0
Poor national economy	3.0	3.3
Poor educational Opportunities for kids	5.0	3.7
Family abroad	5.0	4.6
Others -high taxes (7:1) -poor water/sanitation (1:3)		

Summary and lessons to be drawn from preliminary findings

Brain drain studies of Africa have often relied on data covering the entry of African experts into destination points in the Western developed countries. Typically, this is the only type of data available. It is becoming increasingly obvious, however, that destination point data do not provide much insights into why experts leave their home countries in the first place. The need for a study or studies to assess source conditions that act as push factors in the migration process is now almost incumbent if serious mitigation strategies are to be developed to combat the negative impacts of the RTT.

This study is an initial attempt towards this end. It uses University of Zimbabwe academic staff to ferret out why African experts decide to emigrate, their potential destinations, and the factors that attract them to their potential destinations. The experts in the study are divided into two groups : those who express a desire to emigrate in the near future and those who do not. The survey results suggest that economic considerations factor significantly in the decision-making process of experts. This confirms what has been assumed in the literature for a long time. However, the results clearly indicate that the sociology of the workplace, political climate of the home country, and educational opportunities for family members, may all be equally as important as economic factors.

From the elementary analysis conducted here of the results of the questionnaire survey, it seems that it is possible to create a profile of each group of experts. This is an important finding. It means that it could be possible for human resource planners to conduct comprehensive

labor surveys and to determine : (a) how to provide incentives so that experts who now express a desire to emigrate could be convinced to stay home ; and, (b) to ensure that those who now express a desire to stay home do not change their mind.

The Zimbabwean case seems to suggest a number of broad lessons for other African countries. (1) There must be good benefits and incentives for young faculty, especially those in the lower ranks. (2) There must be a competitive package of benefits to convince faculty in the 'hard sciences' to stay home. (3) There must be a clearly identifiable structure of merit so that faculty do not become frustrated with what they may perceive as the 'poor work ethic' of colleagues. (4) There must be a clearly identifiable structure for promotion so that faculty do not feel stultified by a perceived absence of career advancement opportunities. (5) At the geographical level, governments must ensure that salary and job benefits are competitive with those of countries in the same region. There is some indication that countries might stand a greater risk of losing experts to their neighbors rather than to countries in the developed West.

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Socio-economics and Socio-politics of Scientific Migrations

Part 4

Migration of the Professional, Semi-professional and Technical Occupations in South Africa: Past Patterns, Current Trends and Policy

David E. Kaplan

Message to Lyndon Johnson
from a Native American.
"Be careful with your immigration
laws. We were careless with ours. "

Introduction

The patterns and causes of scientific migration to and from South Africa are complex. Both the " attractions " and the " repulsions " for scientific and technical persons to work in South Africa have been determined by a variety of political and economic factors. Nor have these been constant over time - these determinants have been changing and are subject, at least to some degree, to policy choices.

By way of introduction, the first part of this paper briefly outlines South Africa's capacities in relation to science and technology. The contrast is drawn, most frequently, with the other African countries, since, as we shall see, scientific migrations as between South Africa and the rest of the African continent has assumed a special importance.

The second part of this paper attempts a " first-cut " examination of the empirical data on " scientific " migration to and from South Africa. A major qualification to make at the outset is that the data referred to here relate not to the migration of " scientists ", but rather to the category of " Professional, semi-professional and technical occupations. " Immigration and emigration figures exist for this category, but not for the more narrow grouping of " scientists [1] ". Unless designated otherwise, the discussion in this paper therefore relates to this broader occupational category, rather than to " scientists " more narrowly conceived. The paper examines the recent data on emigration and immigration - both the overall data, but also focusing on two important occupational sub-categories, namely doctors and engineers. The paper briefly attempts what historians term a " periodisation " ie. the identification of long time periods, broken up by major turning points, wherein the underlying factors and trends are reasonably constant. Particular consideration is paid to the continental (Africa-wide) dimensions of this migration and the regional dimensions (the SADCC countries) and the case of the key SADCC country, in this respect, Zimbabwe.

By way of conclusion, the paper briefly outlines current government policies as well as the analysis and proposals advanced by the very recent report of the Labour Market Commission in regard to this question.

Part 1 : South Africa's science and technology capacities

Post World War II developments in S&T

South Africa established a dedicated S & T system after World War 2, with the founding of the CSIR in 1945 South Africa's oldest and largest science council. The CSIR was conceived of as a national research organization and essentially similar to government laboratories established in the advanced countries. National laboratories were established for the basic sciences and these formed the core of the organization. There were other attached institutes that were more industry oriented, but the organization was primarily science driven. The freedom of individual researchers was respected and much emphasis was placed upon scientific publications. The CSIR was the leading research institution in South Africa and by 1985/6 was estimated to be responsible for performing 13 % of all the research undertaken on the continent of Africa [2].

Commencing in 1987, the CSIR was substantially restructured. Its 23 research institutes were replaced by eleven divisions or " strategic units ". Each strategic unit was focused on the needs of a particular market segment. A focus on applied research and a greater market orientation was also to characterise all the other government supported S & T performers.

Scientific research was also historically well-established in the university system, after World War 2. Apartheid ensured that the university system was heavily segregated. The " white " universities largely structured along Anglo-Saxon lines, disciplinary based with a research culture including tenure and reward for scientific publications, were significant sites of scientific research. This continues, but in the last few years government has been demanding an increasing emphasis on research that is relevant to national needs and supporting the development of research at the former black universities.

Inputs

In 1993/94, South Africa expenditures on R & D amounted to R2.6 billion (approximately $65 billion). This represents 0.75 % of GDP [3]. Over the last decade or so, total expenditure on R & D has shown a general tendency to decline - R & D has declined more rapidly than capital expenditure and R & D personnel as a percentage of the workforce has also declined.

Much of South Africa's technology thrust developed can be described as " mission-oriented " i.e. focused on radical innovations needed to achieve clearly set out goals of national importance. Most important have been technology development in respect of atomic energy and armaments [4]. It is not possible to calculate precisely the importance of R & D expenditure in these areas, but R & D in armaments directly exceeds R290million (or more than 10 % of total R & D spend) and 22 % of the Business sectors's spend on R & D [5]. The recent White Paper on S & T states the figure on Defense S & T to be R534million [6]. Over the past 26 years, over R14,600 million has been invested in atomic energy. While the R & D component of this expenditure is not known, it is certainly considerable. Atomic energy and armaments together therefore absorbed a considerable part of the resources historically invested in R & D. These areas - particularly atomic energy - are now attracting far less funding and further reductions are very likely.

Outputs

The number of South African publications in the Science Citations Index (SCI) was 3,700 in 1992. Publications increased steadily until 1987, but have declined since then. The decline has been most pronounced in respect of publications emanating from the universities whose publications declined by one-fifth between 1988 and 1991.

South Africa's share of total world SCI is currently a little under 0.5 %. South Africa's share rose to 0.6 % in 1986, and remained at this level until 1988, declining thereafter [7]. Citations are currently well below the international average in all fields except agricultural sciences. A recent assessment of the number of South African scientific publications and citations characterised South African science as " anaemic " and dramatically highlighted the extent of its decline in the period 1981-93 [8].

Nevertheless, South Africa's share of publications in the SCI is large by comparison with that of other African countries. In 1993, South African publications in the SCI were approximately equivalent to those of Egypt, Nigeria, Kenya and Zimbabwe combined.

South African origin patents registered in the US have exceeded 100 since 1987. South Africa is responsible for approximately 16 % of the patents granted to southern hemisphere countries in the US - second largest but well behind Australia. South Africa certainly dwarfs the international patenting of the rest of Africa [9].

Human resources

South Africa's human resources to support S & T are comparatively very poorly developed. This is evident at all levels. To take just one indication of this, in 1990, South Africa had a total of 121,000 scientists and engineers - approximately 3,000 per million population. In 1985, South Africa had some 8 % of the continent's scientific and engineering workforce [FRD, 1993 : 50]. Comparisons of graduating engineers per annum, reveals even more sharply, South Africa's poor performance by comparison with the NICs and indeed with a number of African countries.

Moreover, Blacks are severely under-represented in the ranks of scientists and engineers. To take but one indication of this. Of a total of 3,123 graduates employed by the science councils in South Africa in 1994, 2,975 or 95 % were White [10]. Overall, in 1990, only 18 % of all scientists and engineers in South Africa were black [11].

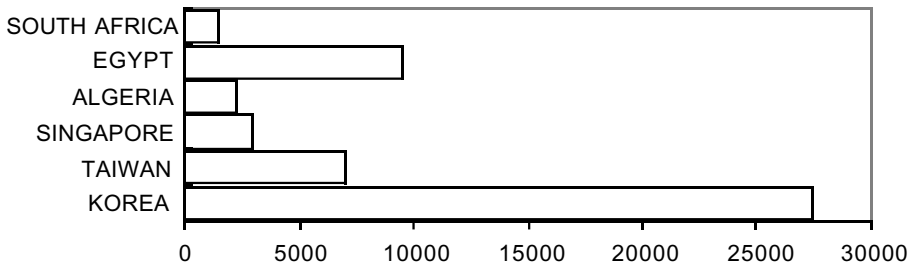


Figure 1. Graduating engineers per annum

Part 2 : Migration patterns - The data

The overall pattern

In the period 1947-1993, South Africa enjoyed a net gain in migrants in forty of those forty six years. The same picture holds for the professional and semi-professional category. In the last 10 years period, by contrast, there have been 4 years - 1986 and 1987 and 1994 and 1995 - when a net loss was experienced, both overall and of the professional and semi-professional category. It seems very likely that 1996 will also see a net loss [12].

Figure 2 and Figure 3 chart immigration and emigration (a) for all occupations and (b) for the professional and semi-professional category, over the last decade.

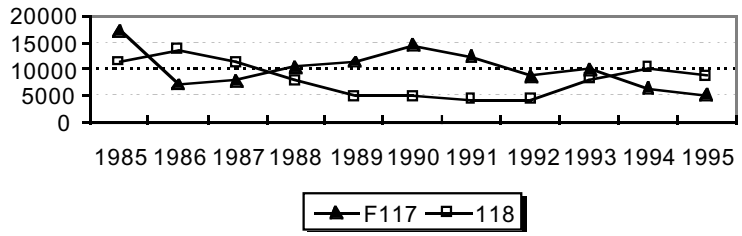


Figure 2. Total immigration and emigration, all occupations

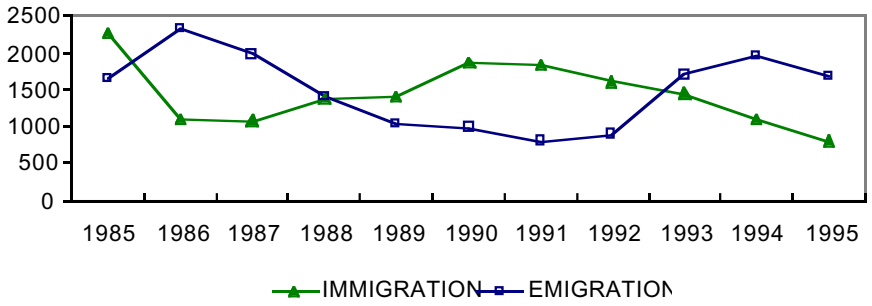


Figure 3. Immigration and emigration, professionnel, semi-professional and technical

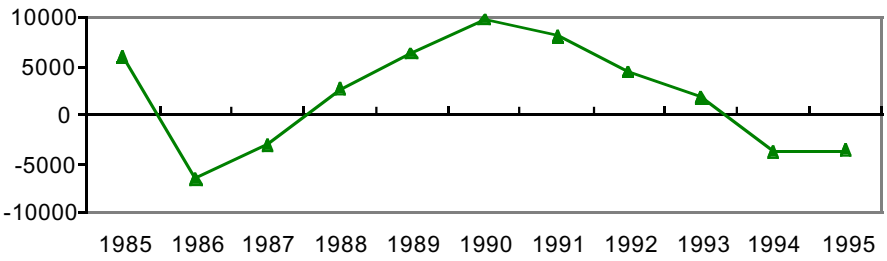


Figure 4. Net gain, all occupations

As is evident, from the two Figures showing net gain, the movement of all occupations and of the professional and semi-professional categories track each other very closely, suggesting that there are very similar explanatory underlying factors.

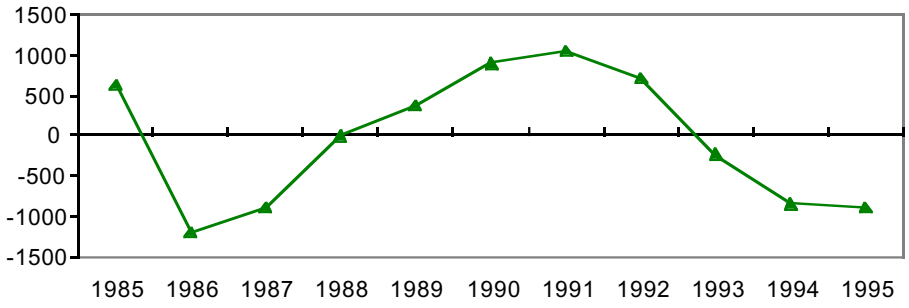


Figure 5. Net gain, professionnel, semi-professional and technical

The migration of the professional category A periodisation, 1960-1995"

Over the last three decades, South Africa has enjoyed long periods in which " scientific " migrations have been positive (inflows exceeding outflows). These periods have been punctuated by much shorter (hitherto never more than two years) periods of outflow, with the key turning points being marked by clear political episodes. Five periods can be distinguished.

Immediately following Sharpeville (1961), outflows increased dramatically. But with the high rates of economic growth thereafter outflows declined and inflows rose. In 1964 total immigration was nearly 41,000 with less than 8,100 emigrating for a net gain of nearly 33,000. In that year, for the professional category, there were almost 3,200 immigrants and a little over 900 emigrants - for a net gain of 2,256. The mid-1960s were the high point, but positive inflows continued.

This period saw the highest and most sustained level of inflow. What fuelled this inflow was a combination of the following factors - high rates of economic growth (much of that relating to capital and skill intensive industrial development) ; the development of so-called 'strategic projects' which were funded by government for political reasons and to lessen South Africa's external dependency, such as oil from coal, uranium enrichment [13] and armaments ; and a sustained attempt by government to attract white (particularly skilled) immigrants.

Following nation-wide unrest (1976), outflows increased substantially and inflows declined. Nevertheless, inflows still tended to exceed outflows - albeit by a much lower margin than in the 1960s. Similar factors underlay the flow of skilled labour in this period except that the growth rate slowed considerably and became more volatile - as a result inflows were at a lower level. Outflows were also at a higher level, principally because of mounting political uncertainties.

Overall though, these two periods saw major gain in the inflow of professional and skilled persons. It has been calculated that in the two decades after 1965, immigration accounted for about one-fifth of South Africa's increase in high-level personnel [14].

The next turning point coincided with deepening unrest combined with the government's refusal to countenance reform (epitomised in President PW Botha's 'Rubicon' speech) and the imposition of a state of emergency (1985-7). In 1986 and 1987, emigration substantially exceeded immigration. Immigration was at a historic low and emigration at a historic high. The major factors here were political turmoil, combined with a pronounced economic depression.

This initiated the fourth phase. Immigration increased somewhat, at least until 1990, while emigration declined dramatically - and there was a positive net inflow, until the end of 1993. However, there are some doubts as to the validity of the emigration figures. There is no data series for emigrants the first 9 months of 1993 due to a change in the departure form which did not elicit proper information. There were, at this time, very large discrepancies as between government

and other estimates for the number of emigrants [15]. There are various reasons, principally relating to exchange control, which lead many emigrants not to declare themselves as such. The likelihood is that the official emigration figures for the last few years are underestimated [16].

In the fifth and final phase, since the formation of the Government of National Unity, in 1994 and 1995, South Africa experienced two years of considerable net outflow of the professional category. Emigration is showing a declining trend on the statistics, but there is some evidence to suggest that it may be rising - particularly for skilled personnel [17]. Immigration is also showing a significant declining trend - see Figure 3. By comparison with January 1995, the data of January 1996 show a decline in immigration (68 to 53) and a particularly sharp rise in emigration (222 to 320) [18]. The gap is therefore increasing rapidly.

Three consecutive years in which there is a net migration of professional people is unprecedented. Moreover, there are indications of more long-lasting changes in respect of both immigrants and emigrants.

With regard to immigrants - between 1990 and 1993, there were " new " sources of immigrants - from Eastern Europe and Africa and, to a lesser extent, returning exiles. Nevertheless, the number of immigrants declined over this period. All these 'sources' of immigrants have largely dried up - the exiles have now returned ; immigration from Africa and particularly the SADCC countries has been on a long term decline (see below) and Eastern European immigration has also slowed considerably. But, much more significantly, government policy, or at least policy followed by the Department of Home Affairs, has, for the first time in South Africa's post-War history, sought to positively discourage immigration, including immigration of skilled and professional people (see below). The number of immigrants in the professional category has therefore declined markedly and consistently and is at a historic low.

With regard to emigrants, there was a major increase in the period just prior to and consequent on the formation of a new Government of National Unity. Emigration then slowed, but remains at a high level. As opposed to previous major periods of emigration that were precipitated by political events, there are indications that skilled emigrants in the period 1984-1994 have been more motivated by economic than political reasons (Argus 11/8/95). However, other socio-political factors, particularly the very high rates of crime, are increasingly stated as being the primary motivation for emigration on the part of skilled and professional people.

Economic performance is now improving and will be a major determinant of emigration, but the crime rate is growing. Moreover, declining government support for certain science-intensive activities - from uranium enrichment to higher-tech. curative medicine - are also promoting more emigration of the professional category. It therefore is very likely that emigration of professionals will continue to remain high [19].

The likelihood therefore is that South Africa will continue, at least in the short term and in the absence of any major policy changes, to experience a net outflow of professional and technical category - with important implications for further development.

The Migration of doctors and engineers, 1985-1995"

Within the professional, semi-professional and technical category, data is available for the subcategories of doctors and of engineers [20]. With regard to engineers, the data show net losses were experienced in 1986 and 1987 and then strong net gains until 1990. There after, the net gain declined steeply. Although, the 1993 figure was positive it is unreliable. 1994 and 1995 both registered a net loss and it is likely that 1996 will do so too, with the net loss increasing.

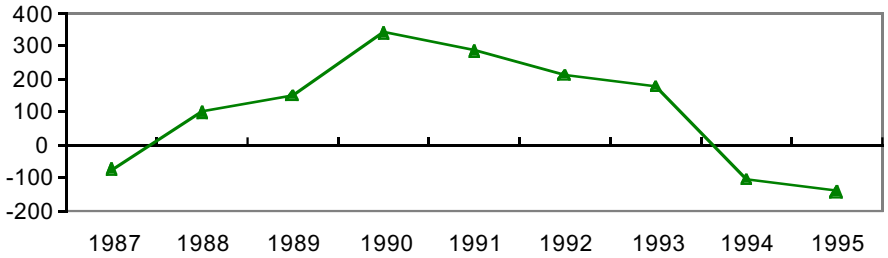


Figure 6. Net gain: engineers and related

Reliable data for the number (stock) of engineers in the country could only be obtained for the period after 1990. From a significant augmenting of the stock of engineers in 1990 (2 %), the 1994 figure is a negative 1 % and this negative trend continued in 1995 and in January 1996. A superficial look at the data suggests that migration of engineers is particularly sensitive to the economic climate - much more so than is the case for doctors, for example. With regard to doctors, there was a net outflow in 1986-87 and a marginal outflow in 1988. Net inflows then rose steadily until 1992. We know a little more about the composition of these immigrating doctors. Of the 1,897 foreign-trained doctors who came into the country from April 1990 to December [1991], 1,700 were immigrants. A small percentage of the remaining 200 were returning exiles; the rest were South Africans who, for various reasons, had studied abroad. " *Weekly Mail*, 21/2-28/2 1992. These sources 'dried up' after 1992 and inflow declined - it was negative in 1994 and in 1995 too. However, as a percentage of the stock of medics, net inflow or outflow has been quite limited over the last decade.

The South African Medical and Dental Council estimates that about 150 doctors emigrate each year (approximately 0.7 % of the stock) [21]. Given that the number of doctors graduating a year is growing at marginally more than 1 % per annum with population growing at 2.3 %, this is causing great concern in medical circles and in the restructuring of the health services. The South Africa Medical and Dental Council has asked for a review of doctors salaries and working conditions (*Sunday Times*, 5/5/95).

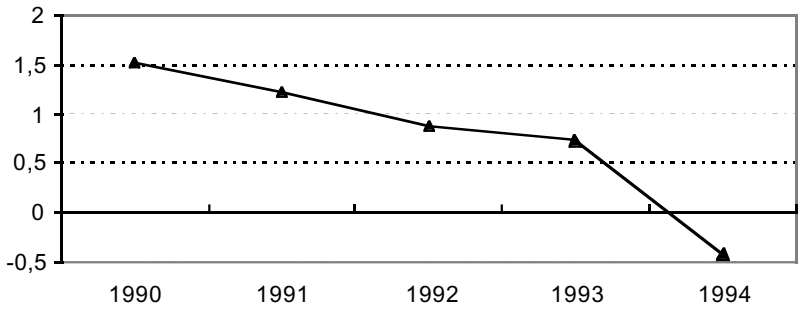


Figure 7. Net gain as % of stock of engineers

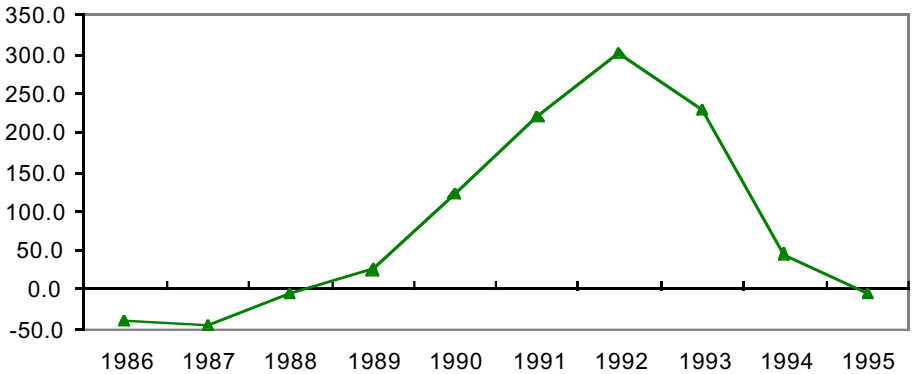


Figure 8. Net gain of medics

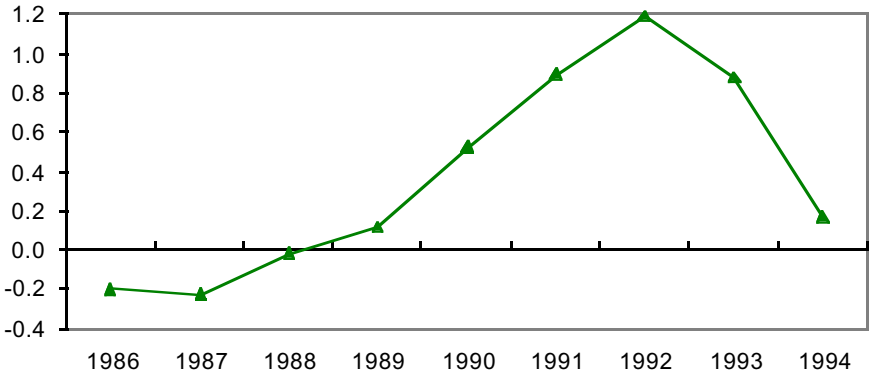


Figure 9. Net loss of medics as % of stocks

Migration to and from Africa and the SADCC countries, 1985-95"

Over the last decade, there has been a pronounced inflow of professional, semi-professional and technical persons to South Africa from elsewhere in Africa. Immigration has been on a declining trend however. Emigration from South Africa to elsewhere in Africa has been very limited - below 100. However, since 1993 this has increased and is now about 200 per annum. The " gap " has therefore closed considerably and the trends suggest that the outflow from South Africa to Africa will exceed the inflow.

A similar trend can be discerned in relation to the SADCC countries. While historically South Africa has been a major recipient of professional, semi-professional and technical persons from the region, the situation has now altered and in 1995 there was a net outflow from South Africa to the SADCC countries.

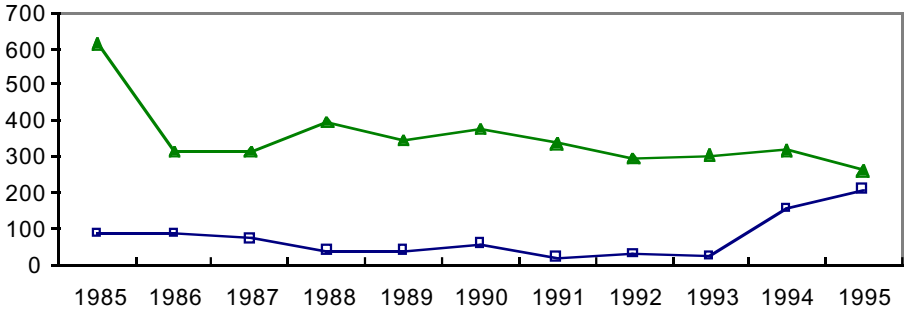


Figure 10. Immigration and emigration from Africa, professionnel, semi-professional and technical

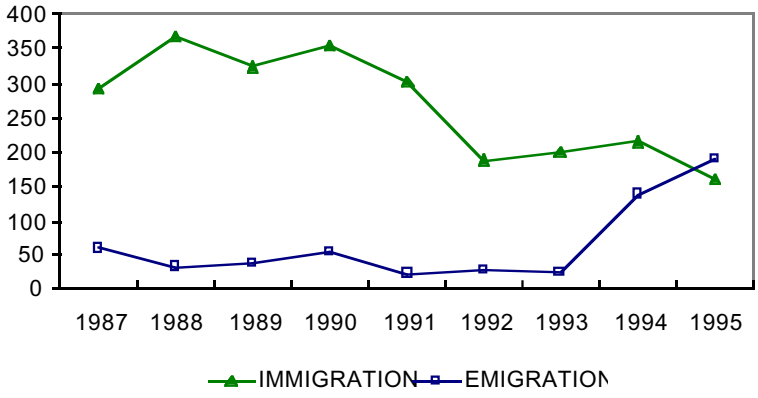


Figure 11. Immigration and emigration from SADCC, professionnel, semi-professional and technical

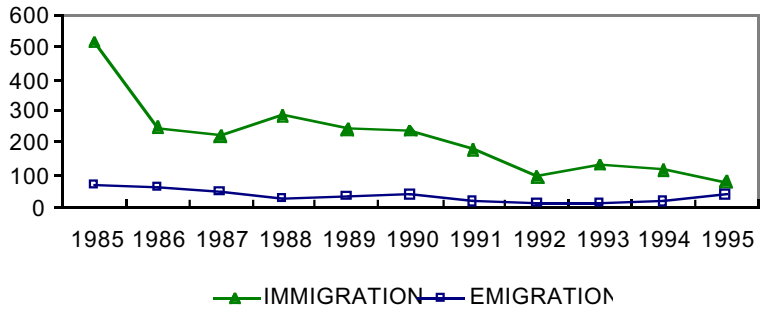


Figure 12. Immigration and emigration from Zimbabwe, professionnel, semi-professional and technical

On a disaggregated basis, these trends can also be seen at a country level. Thus, in relation to Zimbabwe, which has been the major SADCC country in relation to both outflows and inflows of labour [22], emigration is decreasing and immigration increasing and a " cross-over " is likely for 1996.

There have been strong calls from countries in the region, particularly from Zimbabwe, for South Africa to place restrictions on the entry of professional and skilled persons from the region. These restrictions are advocated in the interests of regional development. However, as we have seen, the trend is now reversing. Also, there is a notable migration of professional, semi-professional and technical persons from north to south, such that countries which have seen major outflows to South Africa have also seen major inflows from other African countries further north where levels of development are even lower. If South Africa imposed restrictions on inflows, this would not address the developmental problems of other African countries.

Overall, only a small part of South Africa's professional, semi-professional and technical personnel emigrate to other African countries (11 % in 1995). However, although the absolute numbers of immigrants from elsewhere in Africa have been falling, a much larger and growing share of South Africa's immigrants are from other African countries (16 % in 1991, but 37 % in 1995). In the event that South Africa were again to be a major net recipient of professional and skilled labour from Africa or the region, any proposed policy measures would need to assess the continental-wide impact of such flows.

Part 3: Conclusion - Some policy dimensions

For the first time in the post-War period, South Africa is experiencing a significant and a protracted period of brain drain of professional, semi-professional, and technical personnel. Emigration persists at high levels despite the fact that the economy is currently growing at a higher rate than it has at any time since the early 1980s. Emigration is clearly less sensitive to the economic climate than it has historically been. Other factors are coming into play - high crime rates and the reorganisation of the state services in the fields of health and education, in particular, are two evident factors. However, there is no firm evidence on the effect of these factors, or any others on emigration.

Similarly, immigration is historically at the lowest levels recorded. Moreover, levels of immigration are declining even further. This is true, even in relation to immigrants from Africa and the region. Once again, this is occurring in a period of reasonable economic growth. There are a number of factors which may account for the low levels of immigration, but firm evidence is

again lacking. However, what is clearly evident is that there has been a pronounced change in policy towards immigration.

Historically, immigration was encouraged, particularly in those occupations where there was an identified shortfall in suitable local applicants. In practice, this meant that there were no real barriers to immigration on the part of skilled and professional people. Under the Government of National Unity, the Department of Home Affairs has enforced the terms of the Aliens Control Act rigorously. Moreover a number of amendments to the Act have been passed which makes it far more difficult for skilled as well as unskilled workers to obtain work in South Africa. For example, all applicants for work permits and workseeker's permits and study permits will have to be made from outside the country. The Labour Market Commission report recorded.

Strong anecdotal evidence suggests that applications for work permits from skilled workers and potential investors are dealt with in an unsystematic and haphazard manner. It is argued that long term growth is hindered by skill shortages. This shortage is manifest in part, in unusually large occupational differentials. Under these circumstances, there are few grounds for a restrictive approach to applications for work permits from skilled foreign workers. Furthermore there is ample evidence to suggest that too little effort is being made to draw skilled foreign labour from developing countries, where the price of hiring this labour in South is far lower than the employment of an equally skilled foreign worker from an industrialised country. In this respect, the Commission is also particularly concerned at the role accorded to local professional associations who adopt a highly protectionist stance to the entry of foreigners into their ranks [23].

There are numerous reports of companies encountering enormous difficulties in obtaining permission from Home Affairs to allow skilled workers to obtain work and residence permits.

South Africa continues to have significant shortages of skilled workers [24]. Moreover, the wage gap as between professional and technically skilled occupations and unskilled workers is extremely high in South Africa [25]. Restrictions on the immigration of professional and skilled workers serves therefore to retard development and to exacerbate inequalities. This has prompted the Labour Market Commission to advocate a reversal of policy relating to immigration so as to actively encourage the immigration of professional and skilled people.

Countering emigration is far more difficult. The proposal that medical graduates, for example, would not be registered until they had done some service locally, is designed to limit the emigration of newly qualified doctors. But, such restrictions have strong disadvantages and may be difficult to enforce. Moreover, registration is not applicable to most other professional categories.

There is a need for much further research on the factors that underlie current trends in the immigration and emigration of professional, semi-professional and skilled persons from South Africa. As outlined above, the past does not serve as a good guide to the present - new determinants have entered the picture. Research particularly needs to unravel those determinants that may be influenced by policy. In the absence of a re-alignment of policy, the rapid and persistent haemorrhaging of professional, semi-professional and technical persons will significantly undermine the development prospects for post-apartheid South Africa.

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[1] The major sub-categories here are the following : Engineers and related technologists ; medical practitioners, specialists and dentists ; education and related occupations ; accountants and related occupations ; other. Engineers would generally be included in « scientific » migration studies - and hence the data relating to this specific sub-category is isolated and presented here. The other sub-categories would include but would also be wider than that of « scientists » conventionally understood. The data for the entire category Professional, semiprofessional and technical occupations are a measure of overall brain drain/gain.

[2] Garbers, C. (1989), quoted in Lutjeharms and Thomson, (1993).

[3] DACST, 1996 : 19.

[4] Oil from coal and, to a lesser extent, telecommunications equipment have also seen extensive technology development, driven by the state on the grounds of their strategic importance.

[5] In 1991/2, the Defense Department contributed R97million to R & D directly ; a further R51million was allocated by the different branches of the armed forces to « technology retention projects » and R & D to the amount of R100million was supported by capital projects. A further R30million was contributed directly by the Armaments Corporation (Armscor) itself and R13million by Denel. This excludes student bursaries and other forms of support on the part of Armscor and, most critically, defence related R & D in the private sector which is not directly supported by Armscor. The data in this paragraph were obtained from Garbers, C. F, 1993.

[6] DACST, 1996b : 48.

[7] FRD 1993 : 236.

[8] Mitton, 1995 : 1.

[9] Between, 1980 and 1990, South Africa had a total of 1,047 patents granted in the United States. Egypt had a total of 19 and Morocco 15 [FRD, 1993 : 246, Appendix 5-14

[10] LHA Management Consultants, 1994 p. 3.

[11] FRD, 1993 : 196.

12 Data are only available for January 1996. In that month the net loss in the professional, semi-professional and technical occupations was 267. This compares with a net loss in January 1995 of 154.

[13] CSS Statistical Release P0351. May, 1996.

[14] In 1994, the Atomic Energy Corporation (AEC) employed over 3,000 people, the largest single concentration of high-level skills in the country - most of whom are highly skilled. This may be compared with a total of 22,223 man (sic !) years devoted to total R & D in South Africa. and armaments - all of which were highly skill intensive.

[15] Between 1965 and 1985 net migration contributed about 20 % of the increase in high-level personnel. Barker, 1992 : 48.

[16] See for example, the data supplied by the South African Reserve Bank and the experience of the large removal companies in 'Brain drain 'a myth'. Official statistics at odd with exodus claims' The Star, 9/8/93.

[17] Of those who effectively emigrate without declaring that they have done so, many will eventually register as emigrants. As a result, there is something of a lag in the real figures for emigration.

[18] Skilled personnel emigration figures are said to have jumped by 800 % in the past two years and employee resignations due to emigration have been increasing steadily, according to one recent survey. 'Emigration jumps 800 %', Business Day 19/1/96.

[19] CSS, Statistical Release P0351, May 1996.

[20] As indicated by the data for January 1996. Emigration increased by 44 % over the same month in 1995.

[21] Doctors include medical practitioners, medical specialists and dental professions. Engineers and related technologists cover all categories of engineering.

[22] The chairman of the academic doctors group has stressed that reliable figures are difficult to obtain : « Some specialists go overseas but don't have their names removed from the medical register....Others leave for six months or a year, earning double or treble what they can earn here to work of their debt, then come back. But our impression is that we're loosing people permanently at a more rapid rate than in the past. » (Cape Argus, 29/9/95)

[23] Zimbabwe has generally accounted for more than 50 % of South Africa's immigrants of professional, semi-professional and technical personnel from the SADCC and for a similar share of emigrants - although the latter has been falling strongly and is now only 20 % of the SADCC total.

[24] Labour Market Commission, 1996 : 228.

[25] The last survey on nationwide vacancies was undertaken by the National Manpower Commission in 1992. Despite the fact that the economy was performing poorly, there were high vacancy rates in many of the professional and technical occupations. The occupation with the highest vacancy rate was the supplementary medical profession (38.5 %), followed by engineers in the agricultural sector (23.1 %) and the education professions (22.8 %).

Labour Migration of Highly Qualified Colombians: the Experience of the Caldas Network

Carlos Germán Murcia
Luz Stella Parrado

Introduction

The historical framework that provides the context for labor migration coincides with the spread of the capitalist economy. A good part of the literature that addresses this issue places emphasis on economic and political factors as the determinants of migratory flows (BOROCS and PORTES 1995) [1]. Thus the most traditional theoretical perspectives to explain the phenomenon, based on an unsatisfied relation between supply and demand in the international labor market, suppose a world divided into countries which are economically strong, highly hegemonic, and having clear migration destinations, with the developing countries being the source of emigration. It supposes a labor market characterized by homogeneous groups of individuals interested in greater income based on pay scales that differentiate degrees of qualification.

Geopolitically, economic globalization is considered to be a factor that influences the nature and dynamics of migratory labor flows. Firstly because it accelerates the growth rate and secondly because the direction of these migratory flows has changed in terms of their origin and destination, this is to say that the destination countries have diversified, for example Japan and Australia have started to attract migration. Equally, intra-regional migration has been taking place in which underdeveloped countries are destination options and developed countries are the source of emigration to countries with a similar level of development. Now the developing countries are not the only sources of emigration, this has extended to developed countries in the framework of regional reconfiguration between countries, like in the case of the European Community.

More people are working abroad and the dynamics of the situation have become more complex, transcending national borders, and accompanied by an acceleration of mobility in capital through the channels of the multinational companies. As a complement, it is said that incorporating highly qualified personnel accelerates productivity in the companies and thus the human resources can be transferred for profit just like any other resource ; in this perspective the labor market directs the flow of highly qualified personnel in order to increase the aggregate value of its operations.

Seen from the point of view of the destination countries, the process of selection was increasingly consolidated based on the need to integrate highly qualified people into their economies, considering the strategic needs of the companies given the relative scarcity of specialists in the country [2]. In order to select qualified immigrant labor, various factors come into play such as the number of years of schooling, the prestige of the institution granting the academic degree, professional experience in specific and specialized work areas, the nature of the institutions

where work experience was acquired, etc. This market tends to be segmented in response to the increasingly specific demands of the domestic economies (SALT 1995).

With these considerations, the destination countries have been the ones that rapidly developed policy strategies and sophisticated instruments to selectively regulate labor immigration flows ; in some cases they even established time limits for the duration of the contracts and the amount of time that the foreigners may remain in the country [3]. As well, it can be seen that developing countries encourage the export of human resources in order to increase their national income by transfer of foreign currency (FERNÁNDEZ 1992) [4]. though this process could have damaging effects in terms of the loss of human capital.

In summary, studies that address the migration phenomenon have outlined have two approaches for analysis : the first, theoretical, takes the concept of brain drain and tries to estimate the positive or negative effects that the exodus of talent has on the developing economies. The second refers to migration policies which are applied by the countries of destination and origin, according to strategic interests associated with technological and scientific development programs in association with the dynamics of the productive systems.

The Colombian situation [5]

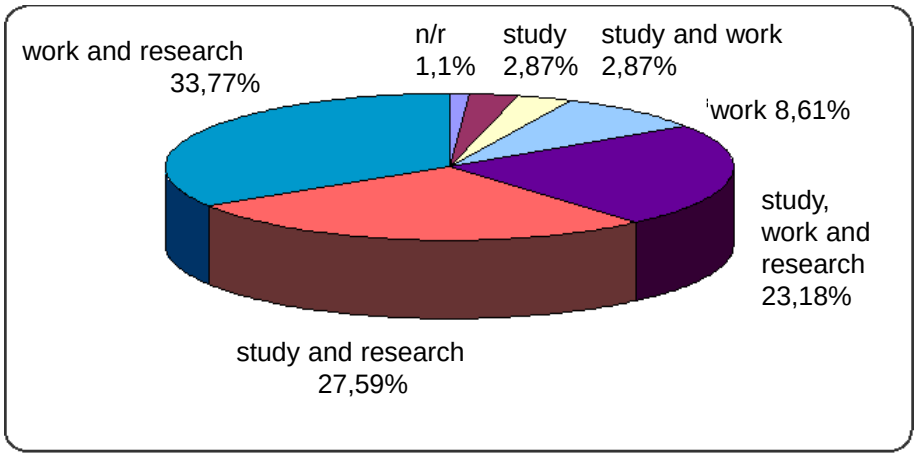
The interest in gaining an understanding of the labor dynamics of Colombian scientists and professionals residing outside the country is partly due to the need to integrate theoretical and methodological perspectives that can provide an explanatory framework in order to address a phenomenon on which little research has been done in Colombia and that is of growing interest to governments who wish to develop strategies that will cement the links between non-resident Colombian scientists and professionals with national research groups, with the objective of strengthening national science and technology.

In this case, the migratory phenomenon can be considered as a progressive mobility process or permanent presence in the destination countries. The emigration of highly qualified Colombians, or of those who are in the process of obtaining advanced degrees, is not always due to a desire to remain away for extended periods. To the contrary, the stay may be transitory and might be due to immediate plans, in the case of students.

The migratory routes

The term brain drain is usually reserved to describe the mobility of high level scientists and professionals who emigrate from their respective countries of origin in search of better material living conditions and better opportunities for obtaining the resources needed to work in their areas of scientific and technological interest. With these considerations, the individuals emigrate with a certain criteria or with the expectation of undertaking specialized studies and, once finished, they remain and establish work ties in countries different from the country of origin.

The Caldas Network was surveyed as to the reasons its members left Colombia. The principal reason cited by 75.46 % of the members was in order to further their studies, particularly to do master´s degrees, doctoral degrees or post-doctoral studies.



Graphic 1. Make-up of the Caldas Network according to the activity of its members
Source : Colombia Networks' Survey

In 1995 (Graphic 1), 56.51 % of the members were still studying, most towards doctoral degrees. This activity was combined with work and research in the country of residence and some had current contract agreements in Colombia. Thus only 2.87 % were dedicated exclusively to their studies. The regions most often chosen in which to pursue specialized studies were western Europe where 46.05 % went to study and north America where 33.68 % went.

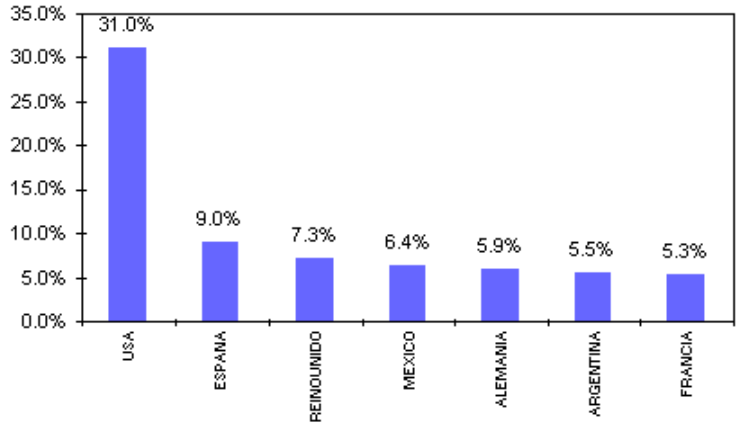
The above observations do not substantiate the general existence of the phenomenon of brain drain in the case of the Caldas Network, given that a good part of this community has student status in the foreign country. Furthermore, since five years is the average time that these individuals remain in the destination country, a time frame that coincides with the time necessary in order to complete a doctoral degree, we can affirm that these are transitory migrations.

Colombian trajectories

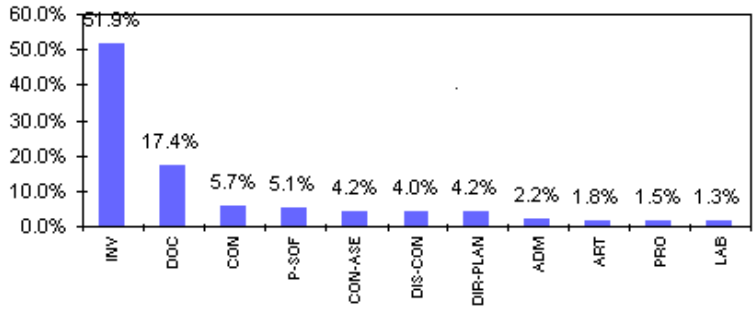
One of the most common presumptions is that the emigration of scientists and professionals takes place when national industry and scientific research infrastructure is not able to incorporate this human resource (PORTES and BOROCS 1995) [6]. In the case of the Caldas Network, let us underline the fact that the primary motive for leaving the country, for over 75 % of the population surveyed, was to undertake specialized studies, while 10 % of the population went abroad for work reasons and 14.54 % left for other reasons. Even so, more than 50 % of the student population say that they are working as a complementary activity in the countries of residence.

There is the work history gained through a large number of contracts, undertaken in various countries, which represents an accumulation of professional experience and that constitutes a pool of skilled people who could be inserted into strategic sectors for the development of the country. The idea, therefore, is to reconstruct the migration and profesional trajectories followed by members of the Caldas Network, demonstrating these accumulations and abilities.

If we take the work contracts as the unit of analysis [7] (Graphic 2), the country that did the most hiring was the United States. However, this trend been diminishing as western European countries take on more importance. Some regions to which Colombians have not traditionally migrated are also beginning to appear as destinations, for example Africa and Oceania where 3.18 % of the contracts were done. As well, a greater number of contracts are originating in the Latin American region which makes up 14.98 % of the total.



Graph 2. Labor contracts by contries
Source: Colombia Networks' Survey



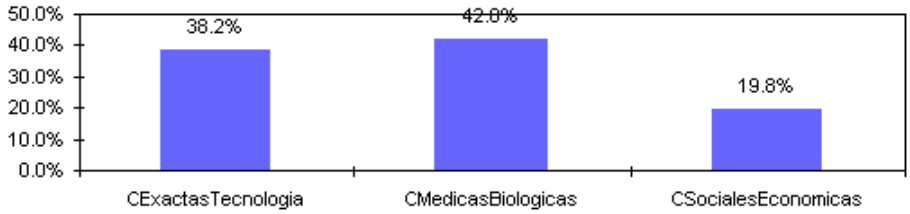
Graph 3. Labor contracts by type of activity
Source: Colombia Networks' Survey

INV: Research; DOC: Teaching; CON : Health care services (doctors, dentists, psychologists, psychiatrists and other health professionals); P-SOFT : Programming and software; CON-ASE : Consulting; DIS-CON : Design and construction (Design and building of civil works, machines and other projects); DIR-PLAN : Management and planning (Activities other than trade and manufacturing); ADM : Administration (Management, administration and other activities related to the market); ART : Artists; PRO : Manufacturing; LAB : Laboratory (Assistants and apprentices).

The setting where the work activities take place (Graphic 3), are described as being academic activities — teaching and/or research — or professional activities; administrative positions, consulting and some related to the productive sector. The marked concentration in research activities can be explained in part by the fact that students who are members of the Network are concurrently pursuing master's and doctoral degrees. As well, teachers also engage in research as a basic part of their work. The relationship between the field of work and the discipline [8] is shown in Graphic 4.

The medical and biological sciences group is divided thus : biology 19.1 %, medical sciences 15.8 % and psychology 7 % [9]. Next in order of importance were the hard sciences and technologies that are made up of applied sciences (computing, civil engineering, telecommunications and other engineering) 23.1 %, chemistry 5.5 %, physics 4 %, and mathematics 3.7 %. In the social and economic sciences the outstanding fields are economics 4.4 %, education 3.7 % and anthropology 3.1 %.

This classification allows us to see clearly the field of work, the type of activity and the disciplines in which these activities are taking place and the countries in which the work is done. This classification is possible because most of the work activity is concentrated in teaching and research, with a smaller concentration in industrial activities. The Caldas Network is, basically, an academic-scientific network.



Graph 4. Labor contracts by area of knowledge.
(basic sciences and technology, biomedical sciences, socio-economical sciences)

Work microsociology of the Caldas Network

Recent studies (FAWCETT 1995) underline the importance of contributing to an understanding of the non-economic motives for migration, which significantly influence these flows. In support of this hypothesis, in our study the variables of schooling, interpersonal relations in the workplace, and attitude and expectations with regard to the current work are related [10].

Variables were explored that could affect the degree of satisfaction with regard to the work done by the individuals. These variables addressed issues regarding the quality of working conditions such as if the work is “ well paid ”, “ intellectually stimulating ”, “ has opportunities for professional advancement ”, “ provides contacts and international mobility ”, “ provides opportunities for work in Colombia ”, “ provides access to technical equipment and/or support from qualified personnel ”. The early results suggest two well defined groups with similar positions with regard to these characteristics. The first group, and the most significant, is made up mostly of people who have obtained a doctoral degree [11], they place great importance on the factors that coincide with their expectations for being a researcher or professional. One of these expectation is the importance of making international contacts — the need to communicate with peers through various means that range from joint authorship to personal contacts. This is closely related to the need to develop conditions that will provide mobility in the international context. This is no longer related to the search for places in which to study but the search for job possibilities and the dissemination of research results. This shows an explicit intent to open up spaces for the recognition of activities and for winning credibility, something that is partially possible when the agent is immersed in a dynamic of constantly constructing relations with his peers — participation in networks, where disseminating the results of research plays a special role.

With respect to daily interpersonal relations and the work environment, there is a great need for peer recognition (if we compare this fact with the number of joint authorships seen in the articles produced by members of the Network, we find that there is a dynamic of cooperative work). In this case, it is clear that scientific researchers normally form groups for this purpose. As well, they need intellectually stimulating work relations, a need that seems evident given that this is a group whose fundamental activity is research, this blurs the hierarchies of formal authority and gives greater value to a hierarchy based on intellectual superiority.

A relevant characteristic is the importance of access to technical media needed for research, dissemination and communication of the research results. For those who undertake these activities, access to communications technology seems to be crucial.

The pay is not considered to be crucial for the realization of work activities, though social and academic recognition are considered to be a necessary stimulus for the work that is undertaken. Recognition can be for the functions or activities that are done and therefore may underline professional competence or it may operate in terms of the scientific product that is disseminated and therefore visibility will be gained in broader social contexts. In this case there is no

strict connection between the scientific production of the Caldas Network and interest in professional advancement, better earnings or a better material standard of living which could be considered to be the natural motivating factors for a highly qualified migrant. To the contrary, what can be observed is a great need to disseminate the results of the activity. To gain visibility and social recognition within the international community would seem to be the most crucial factor for this group of Colombian researchers [12].

The certainty of return

The phenomenon of brain gain was named for a South Asian development policy. These countries were interested in systematically reintegrating their foreign educated citizens in order to provide a boost to industry by strengthening the scientific and technological systems. The return of individuals has been approached by governments through coordinated internal policies for receiving and integrating these people on their return. In contrast, Colombian policy has been to stimulate initiatives between non-resident Colombian researchers and national groups. This policy seeks to create and consolidate cooperative ties to further actions that would promote the development of science and technology in the country (Colciencias, 1993). However, not all Colombians who reside outside the country will remain there indefinitely, 77 % of the expatriate population states the likelihood or certainty of returning. Furthermore, a good number of the Network's students are committed to returning, seeing as this was a condition set out in their contract for funding their foreign studies [13]. In these cases, the state does not have to make any effort to stimulate the return of these Colombians because, effectively, they return.

However, the Colombian government's call to establish the Caldas Network did not differentiate between types of activities practiced by non-resident Colombians, nor the duration of their time abroad, nor the possibility of return, nor the means of cooperation that could exist between them and the national science and technology system. Nonetheless, the Colciencias program for repatriating Colombian scientists must be considered. This program was implemented three years ago and during this time over 50 Colombians with doctoral degrees have returned to work for universities, research centers and some public and private companies.

Therefore it is necessary to differentiate two policies with regard to the Caldas Network. One contemplates the internal conditions necessary for receiving and incorporating scientists and professionals who are sure to return, providing optimal conditions for their integration into the higher education system or scientific research institutions since these are the settings most closely linked to the development of national science and technology. The second policy strategy would be more oriented at consolidating the network of non-resident researchers — those who would remain away indefinitely — in order to interest them in the need to strengthen national scientific development and to work together to find non-location dependent ways that national researcher groups can cooperate with expatriate scientists. Repatriated researchers would act as a catalyst in this process given that they are not only highly qualified on their return but they have important experience that provides them with ties to the international academic community.

The non-resident scientific network

It may be said that the percentage of Colombians who remain abroad is less than that which is commonly thought. Only 22 % of this population states that it will not return to the country. Of the total population that was surveyed, only 13.69 % of the individuals had obtained dual citi-

zenship, allowing us to conclude a definite intent to remain in the respective countries. Most non-resident Colombians are in the U.S. with 33.82 %, the rest are found in France with 16.8 %, Spain with 13.24 %, and in the rest of Europe with 22.06 %. Most of these individuals have permanent work contracts in their country of residence and have obtained doctoral degrees. This is the group which does not intend to return to Colombia and in this sense it is the group that is sought in order to develop alliances and scientific and technical cooperation with Colombia. Scientific cooperation with these researchers has become more concrete because the non-resident Colombians have already developed associative ties based on solidarity and the practice of some Colombian customs. Before the Network was established, some Colombians were already communicating in the communications networks and they organized social and cultural events. These events, along with access to new forms of communication, led to the emergence of the Caldas Network which, encouraged by the Colombian government, has gone about developing the conditions so that this scientific potential can link up with national scientific and technological development strategies. In this case, the Colombian government's strategy is not explicitly related to the need to repatriate the scientific potential as has been done traditionally, rather it considers other modes of cooperation that do not depend on being present in a given locale ; this implies taking into consideration information flow, articles, virtual academic events, research projects being done by geographically distant groups, and service provision, among others.

Conclusions

A good part of the literature on the migratory phenomenon considers it from two perspectives for long term analysis : one that measures the economic and political effects of the migration of highly qualified people, both in the country of origin and the destination. The second refers to the definition and application of selective policies to attract or discourage the international flow, in accordance with each country's strategic interests.

Other studies point out the need to include in the understanding of the phenomenon of scientific and professional migration, other elements which have significant influence in the dynamics of these flows, going beyond the simple notions of " brain drain " vs. " brain gain ". This implies considering the new modes through which scientific knowledge flows and that transcend personal mobility.

Colombian policy, in establishing the Caldas Network, has been to stimulate scientific initiatives and technological development by non-resident researchers in collaboration with national academic groups. This policy seeks to create and consolidate ties for scientific cooperation that are not location specific.

However, it is necessary to differentiate between at least two types of policies that affect the Caldas Network. It is necessary to consider the internal conditions for receiving and incorporating returning scientists and professionals and to select the best conditions for integrating them into the higher education system or with scientific research institutions, given that these are the settings that are most directly involved in developing national science and technology. The second policy strategy could be towards greater clarity in consolidating the Network of non-resident researchers in order to get them interested in the need to strengthen national scientific development and to find non-location specific ways to develop the cooperation system between research groups located in the country and expatriate scientists.

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[1] Contrary to an analysis where international labor migration is basically the result of economic decisions oriented by the law of supply and demand, it can be said that the flows were originally social but that their evolution was increasingly motivated by economic determinants.

[2] In this case, the destination countries stimulate or discourage migratory flows, according to their cycles of economic productivity. Foreigners may be taken on for limited periods of time in order to achieve international competitiveness and to increase productivity.

[3] In the United States, visas for permanent residence are limited to exceptionally qualified and valuable professionals.

[4] When migration takes place between countries of dissimilar development this shows an asymetric relation between them. In this analysis, developing countries lose human capital. This loss could be quantified and its effect on the reproduction of human capital could be calculated.

[5] The analysis of the Colombian situation is substantiated in the research “ El brain drain revisited a través del caso colombiano. La Red Caldas ”. This study included the survey of Colombian networks which provides the basis for all the statistics presented here. The number of non-resident Colombians who answered the survey is 453 individuals.

[6] The qualitative and quantitative analyses were done based on descriptive statistics which were later analyzed and classified using a method of simple correspondences.
“ While developed economies continue to be poles of attraction for the exchange of highly qualified people, in contrast while poor countries continue to undergo rapid population growth and low standards of living there will always continue to be one-way emigration. ”.

[7] In this case, the number of foreign contracts was calculated without taking into account joint work projects with Colombia (which were estimated to be 40.7 % of the total number of contracts), not the number of people who had done these contracts. In total, 472 foreign work contracts were considered.

[8] This classification was done based on the references “Base de données PASCAL plan de classement” and “FRANCIS” of the Institut de l’information scientifique et technique — INIST, of Paris. This classification scheme has seven levels, the first presents three general groupings which are subdivided until reaching very specific activities.

[9] The percentages were calculated based on the total number of contracts : 472.

[10] The factors considered in the survey were : a) schooling, b) current work contract, and c) attitude and expectations of the individuals in their work relations. This information was analyzed with a simple correspondence method, using SPADT software. The statistical results are presented as groupings of individuals with similar characteristics.

[11] The first grouping represents 51.9 % of the population that has a doctoral degree and those whose work activity is in the research field.

[12] Beyond considering the individual benefit of improved earnings as a fundamental reason for migratory flows, it is thought that other motives make migration more fluid and complex, making possible the creation of microstructures that may consolidate over time, may broaden, diversify and stabilize networks made up of varied interests and alliances between individuals, groups, institutions and states.

[13] Until 1993, the Colciencias National Program for Human Resources for Science and Technology had given out 220 grants for doctoral degrees, 6 grants for post-doctoral education and 48 grants for courses. " When they finish their education, the beneficiaries will work at research and technological development activities in Colombia as complete or partial payment of their loan ". (Colciencias, 1993)

Migraciones laborales de Colombianos altamente calificados : el caso de la Red Caldas

Carlos Germán Murcia

Luz Stella Parrado

Introducción

El marco histórico en el que se han tematizado las migraciones laborales coincide con la expansión de la economía capitalista. Buena parte de la literatura que aborda esta temática coloca el énfasis en determinantes económicos y políticos como razones importantes que estimulan los flujos migratorios [1] (Borocs y Portes.1995). Así, las perspectivas teóricas más tradicionales que explican el fenómeno, consideran en su base la complementariedad de ofertas y demandas insatisfechas del mercado laboral internacional; suponen un mundo dividido entre países económicamente fuertes, altamente hegemónicos donde toma lugar el proceso inmigratorio y países en desarrollo estimuladores de la emigración. Se supone un mercado laboral caracterizado por grupos homogéneos de individuos cuyo punto de convergencia sería el interés por un óptimo ingreso en escalas diferenciadas según grados de calificación.

Geopolíticamente, la globalización económica se considera como factor que influye en la naturaleza y dinámica de los flujos migratorios laborales. En primer lugar porque aceleró su ritmo de crecimiento y, en segundo lugar porque esos flujos migratorios se han reorientado en su origen y destino, es decir, que desde la perspectiva de la recepción se ha diversificado la participación de los países, por ejemplo Japón y Australia se han convertido en atractores de migración. Igualmente se ha venido consolidando la migración intra-regional donde países no desarrollados se han convertido en opciones de llegada y paìses desarrollados son fuente de emigraciòn hacia paìses de anàlogo desarrollo. Visto desde el origen ya no sólo los países en desarrollo son la fuentes de emigración, ésta se ha extendido a países desarrollados en el marco de la reconfiguración regional entre países como es el caso de la Comunidad Europea.

La contratación de extranjeros ha crecido en número y complejidad trascendiendo las fronteras nacionales y está acompañada de un aceleramiento de la movilidad de capital a través de los circuitos de firmas multinacionales. De manera complementaria se aduce que la alta calificación incorporada acelera los procesos de productividad de las firmas y entonces los recursos humanos pueden ser transados con fines rentables como cualquier otro recurso; bajo esta perspectiva el mercado laboral asigna personal altamente calificado para incrementar el valor agregado de sus operaciones.

Visto desde los países receptores, los procesos de selección de inmigrantes se consolidan cada vez mas por la necesidad de vincular personas altamente calificadas a sus economías considerando necesidades estratégicas de las firmas dada la escasez relativa de competencias específicas dentro del país [2]. Para seleccionar la mano de obra calificada inmigrante se introducen variables tales como grados de escolaridad, visibilidad de las instituciones académicas donde obtuvieron títulos, experiencia profesional en áreas de trabajo específicas y especializadas, naturaleza de las instituciones donde han conseguido experiencia laboral etc. Este mercado tiende a segmentarse en respuesta a las demandas cada vez más específicas de las economías domésticas (Salt,1995).

Bajo estas perspectivas, son los países receptores los que más rápido han avanzado en la generación de estrategias de política, sofisticando instrumentos para regular selectivamente los flujos inmigratorios laborales ; en algunos casos se ha fijado incluso la temporalidad de la permanencia de los extranjeros y la contratación temporal de los mismos [3]. Por otra parte se aduce que los países en desarrollo motivan la exportación del recurso humano para incrementar ingresos nacionales vía transferencias [4] (Fernández,1992), proceso que puede tener efectos nocivos en términos de la pérdida de capital humano.

En síntesis, los estudios que han abordado el fenómeno migratorio han delineado dos perspectivas de análisis : la primera, teórica, que ha considerado en su base la noción de brain drain intentando estimar los efectos positivos o negativos de la fuga de talentos para las economías en desarrollo. La segunda se ha referido a medidas de política migratoria, que tanto los países receptores como los de emigración han implementado guiados por sus intereses estratégicos asociados a programas de desarrollo tecnológico y científico de acuerdo con las dinámicas de sus sistemas productivos.

El caso colombiano [5]

El interés por comprender las dinámicas laborales de científicos y profesionales colombianos en el exterior responde por una parte, a la necesidad de integrar orientaciones teóricas y metodológicas que provean un marco explicativo para abordar un fenómeno poco explorado en Colombia y al creciente interés de los gobiernos por el desarrollo de estrategias que permitan cimentar vínculos entre científicos y profesionales colombianos residentes en el exterior con grupos de investigación nacionales, con el propósito de fortalecer la ciencia y la tecnología nacionales.

El fenómeno migratorio puede considerarse, en este caso, como un proceso progresivo de movilidad o permanencia estable en los países de residencia. La emigración de colombianos, altamente calificados o en proceso de calificación, no obedece en todos los casos al interés de permanecer por períodos muy prolongados en el exterior, por el contrario, esa permanencia puede ser transitoria y responder a necesidades de carácter más inmediato, como es el caso de los estudiantes.

Las trayectorias migratorias

La noción brain drain ha sido frecuentemente reservada para calificar la movilidad de científicos y profesionales de alto nivel que emigran de sus respectivos países de origen en la búsqueda de mejores condiciones de vida material y mejores oportunidades de consecución de recursos para laborar en áreas de interés científico y tecnológico. Con estas consideraciones los individuos emigran con una calificación incorporada o con la expectativa de realizar cursos de escolaridad especializada y que, una vez alcanzada, permanecen y contraen vínculos laborales en países distintos al país de origen

Para el caso de la red Caldas se indagó por el motivo de salida de Colombia. El 75.46 % de los miembros respondieron que la razón principal fue la de avanzar en su formación académica, particularmente para realizar cursos de maestría, doctorales o post-doctorales.

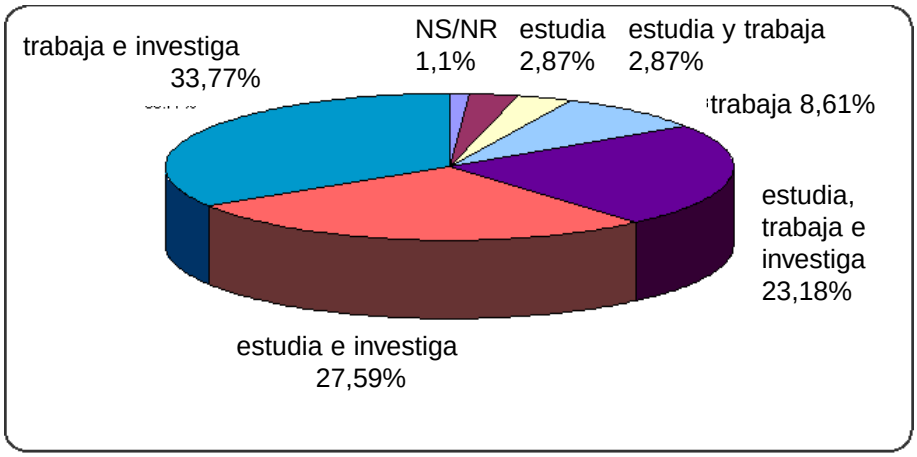


Gráfico 1. Composición de la Red Caldas según tipo de actividad de sus integrantes
Fuente : Encuesta Redes Colombia

En 1995 (gráfico 1) el 56.51 % de los miembros se encontraban aún estudiando, la mayor parte hacían estudios doctorales. Esta actividad la han venido combinando con otras de tipo laboral e investigativo en el país de residencia y algunos de ellos tienen vigente compromisos contractuales en Colombia. Así sólo el 2.87 % de los individuos tiene como única actividad el estudio. Las regiones más frecuentemente seleccionadas para tomar cursos especializados fueron Europa occidental donde el 46.05 % de los estudiantes han optado sus títulos y en Norte América con el 33.68 %.

Con las anteriores observaciones no se puede generalizar la existencia del fenómeno de brain drain para le caso de la Red Caldas, puesto que buena parte de esta comunidad tiene estatus de estudiante en el exterior. Ademàs, puesto que el promedio de permanencia de estos individuos en los países de destino es de cinco años, período que coincide con el tiempo necesario para realizar un doctorado podríamos afirmar que en este caso se trata de migraciones transitorias.

Las trayectorias laborales de Colombianos en el exterior [6]

Uno de los supuestos más frecuentes es que la emigración de científicos y profesionales de los países menos desarrollados toma lugar cuando su estructura productiva y científica no ofrece condiciones para la incorporación de este recurso humano [7] (PORTES y BOROCS, 1995). En el caso de la Red Caldas reiteramos el hecho de que la primera motivación de salida del país, para más del 75 % de la muestra, fue la de avanzar en cursos de especialización mientras el 10 % de la población se desplazó hacia el exterior por razones laborales y el 14.54 % tuvieron motivaciones distintas. Aùn así más del 50 % de la población que estudia manifiesta estar trabajando como actividad complementaria en los países de residencia.

Sin embargo existe una historia laboral representada en gran número de contratos, realizados en diversos países, que puede ser considerada como una acumulación de calificaciones obtenidas por la experiencia y que constituyen un potencial de competencias que podrían ser movilizadas en sectores estratégicos para el desarrollo del país. La idea, entonces, de reconstruir la trayectoria laboral en el exterior de la Red Caldas, permitirá conocer sobre esas acumulaciones y competencias.

Si tomamos como unidad de análisis los contratos laborales [8] (Gráfico 2), la más alta contratación por país se ha obtenido en Estados Unidos, sin embargo este comportamiento se ha venido reduciendo tendencialmente frente al mayor ritmo que se ha venido ganando Europa Occidental. Algunas regiones donde tradicionalmente no tomaban lugar la migración de

colombianos empiezan a tener presencia, por ejemplo en Africa y Oceanía se han realizado 3.18 % de los contratos. Por otro parte se hace más visible una mayor afluencia de contratos dentro de la región latinoamericana donde se han hecho el 14.98 % del total.

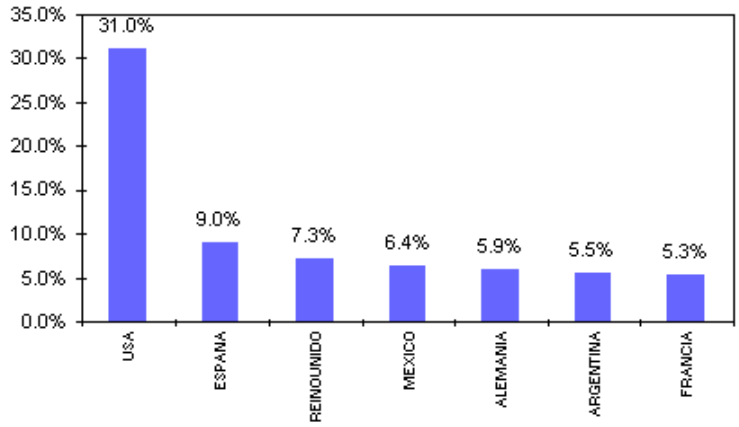


Gráfico 2. Contratos laborales por paises
Fuente : Encuesta Redes Colombia

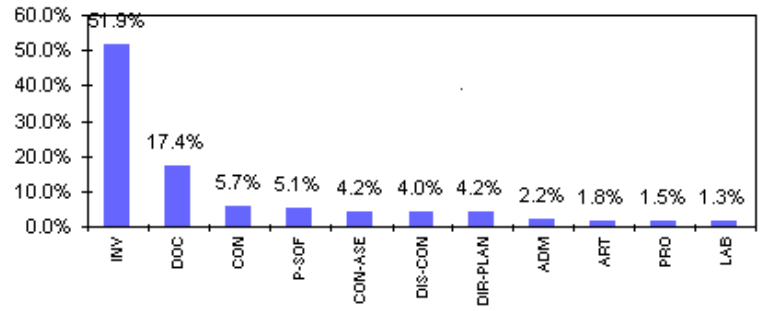


Gráfico 3. Contratos por tipo de actividad
Fuente : Encuesta Redes Colombia

INV : Investigación. DOC : Docencia. CON : Trabajo en consultorios (Médicos, odontólogos, psicólogos, psiquiatras, y otros profesionales de la salud). P-SOF : Programación y software. CON-ASE : Consultorías y asesorías. DIS-CON : Diseño y construcción (Diseño y elaboración de obras civiles, máquinas y otros artefactos). DIR-PLAN : Dirección y planeación (Actividades diferentes al comercio y actividades productivas). ADM : Administración (gerencia, administración y otras actividades relacionadas al mercado). ART : Artistas. PRO : Producción. LAB : Laboratorio (Asistentes y aprendices).

La selección del espacio donde se desarrollan las actividades laborales (gráfico 3), están localmente circunscritos o bien con actividades de carácter académico -docencia y/o investigación - o de ejercicio profesional ; cargos administrativos, consultorías y asesorías y algunas vinculaciones al sector productivo. La gran concentración en actividades de investigación puede explicarse, en parte, por la realización de tesis de maestría y doctorales que hacen los estudiantes de la Red, además los docentes tambíen asumen como actividad indispensable la investigación. La relación entre campos trabajo y áreas disciplinarias [9] es representada en el gráfico 4.

El grupo de Ciencias Médicas y Biológicas está constituido por Biología 19.1 %, Ciencias Médicas 15,8 % y Psicología 7 % [10]. En segundo orden de importancia, el grupo de Ciencias exactas y tecnológicas lo componen las Ciencias aplicadas (Computación, Obras públicas, Telecomunicaciones y otras ingenierías) 23,1 %, Química 5,5 %, Física 4 % y Matemáticas 3,7 %. En Ciencias Sociales y Económicas se destacan Economía 4.4 %, Educación 3.7 % y Antropología 3.1 %.

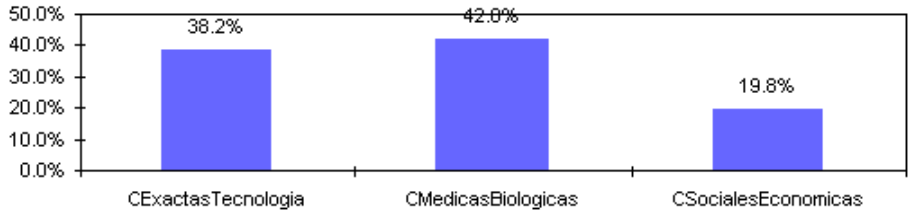


Gráfico 4. Contratos según clasificación base Pascal (Primer nivel)
Fuente : Encuesta Redes Colombia

Esta clasificación nos permite identificar con mayor precisión el campo de trabajo, el tipo de actividad y las áreas disciplinarias en las cuales se insertan estas actividades y los países en qué se han venido realizando. Esta clasificación es posible porque la mayor actividad laboral esta concentrada en la docencia y la investigaciòn y un poco menos en actividades vinculadas al sector productivo. Bàsicamente la Red Caldas es, entonces una red académica - científica.

Una microsociología laboral de la red Caldas

Estudios recientes, (FAWCETT, 1995), llaman la atención sobre la importancia de aportar a la comprensión del fenómeno migratorio motivaciones no económicas que influyen significativamente en la dinámica de estos flujos. Intentando evidenciar esta hipótesis, en nuestro estudio, se relacionaron las variables escolaridad, relaciones interpersonales en su sitio de trabajo, y la actitud y las expectativas frente a su trabajo actual [11].

Se exploraron variables que pueden ilustrar la influencia en el grado de satisfacción frente al trabajo que realizan estos individuos. Estas variables consideraron preguntas en torno a la calidad en las condiciones de trabajo tales como si la labor que se realiza “es lucrativa”, “intelectualmente estimulante”, “con perspectivas de carrera profesional”, “con contactos y movilidad internacional”, “con perspectivas de trabajo en Colombia”, “con acceso a medios técnicos y/o con apoyo de personal calificado”. Los primeros resultados nos sugieren dos grupos bien definidos que se posicionan similarmente ante estas características. El primero, y más significativo, esta representado en su mayoría por personas que su grado de escolaridad alcanza el doctorado [12], ellos ponderan con gran importancia aquellos factores que inciden en las expectativas de su vida como investigador o profesional. Frente a las expectativas se argumenta la primacía por alimentar contactos internacionales - necesidad de comunicación con pares a través de múltiples modalidades que van desde la escritura conjunta hasta los contactos personales -. De manera muy cercana priorizan la necesidad de construir condiciones que les permita movilizarse en el contexto internacional, aquí ya no se trata de encontrar sitios para la formación sino de encontrar posibilidades laborales y difusión de resultados de investigación. Ello mostraría una intención explícita por abrir espacios al reconocimiento de su actividad y ganancia de credibilidad, logro que en parte es posible en tanto el actor esté inmerso en una dinámica de construcción constante de relaciones con sus pares -participación en redes-, donde la difusión de los resultados de sus investigaciones juega un papel privilegiado.

Con respecto a las relaciones interpersonales y con el entorno de trabajo, presentes en la actividad diaria, se declara una gran necesidad de apoyo de personal calificado (si comparamos este hecho con el número de coautorías presentes en los artículos producidos por los integrantes de la Red, encontramos que existe una dinámica de trabajo cooperada). En este caso lo que parece claro es que los investigadores encuentran como forma normalizada de trabajo científico la constitución de grupos para realizar dicha actividad. Por otro lado ellos necesitan que las relaciones de

trabajo se tornen intelectualmente estimulantes, necesidad esta que aparece como evidente puesto que es un grupo cuya actividad fundamental es la investigación por ello se desdibujan las jerarquías de autoridad formal y se da mayor valor a la jerarquía basada en el argumento intelectual.

Una característica relevante es la importancia que se da a la necesidad de acceder a medios técnicos para la realización, difusión y comunicación de los resultados de investigación, particularmente, para quienes desarrollan estas actividades, el acceso a la tecnología de las comunicaciones parece crucial.

La remuneración al trabajo no es considerada como crucial para la realización de sus actividades laborales, mientras que el reconocimiento social y académico es considerado como un estimulante necesario para la actividad que desempeñan. El reconocimiento puede operar en términos de las funciones o actividades que se realizan y entonces puede hacer visible las competencias profesionales, o puede operar en tJrminos del producto científico que se difunde y entonces la visibilidad puede ser ganada en contextos sociales más extensos. Para este caso no encontraríamos una conexión estricta entre la producción científica de la Red Caldas y el interés por acceder a posiciones, obtener mayor ingreso o mejores condiciones de vida material que podría pensarse serían las motivaciones naturales del migrante altamente calificado. Por el contrario, lo que se puede observar es la gran necesidad por hacer explícitos los resultados de su actividad. Ganar visibilidad y reconocimiento social dentro de la comunidad internacional parece ser lo más crucial para este grupo de investigadores colombianos [13].

La certidumbre del regreso

El fenómeno del brain gain se tematizó tras la política desarrollada particularmente por los países del sudeste asiático. Estos tenían el interés de reintegrar sistemáticamente a sus nacionales formados en el extranjero con el ánimo de potenciar su estructura productiva con base en el fortalecimiento de los sistemas de ciencia y tecnología. El regreso de los individuos ha sido coordinada desde los gobiernos a través de una infraestructura interna coherente para su recepción. En contraste, la política colombiana, ha sido la de estimular iniciativas de los investigadores colombianos que residen en el exterior en asociación con grupos nacionales. Esta política busca crear y consolidar vínculos de cooperación para adelantar acciones tendientes a promover el desarrollo de la ciencia y la tecnología en el país [14]. Sin embargo, no todos los colombianos residentes en el exterior permanecerán en esta condición indefinidamente, el 77% de la población expatriada declara la probabilidad o la seguridad de su regreso. Además, una buena parte de los estudiantes de la Red tienen el compromiso de regresar pues ésta es una condición prevista en el contrato de financiamiento de sus estudios en el exterior [15]. En este caso el Estado no tendría que hacer un esfuerzo de política para estimular el regreso de estos colombianos puesto que ellos efectivamente regresarán.

Sin embargo la convocatoria que hizo el gobierno colombiano, para constituir la red caldas, no diferencio el tipo de actividad que estaban realizando los colombianos en el exterior, ni la durabilidad de su permanencia afuera, ni la posibilidad de regreso, ni las modalidades de cooperación que podrían darse entre aquellos y el sistema de ciencia y tecnología nacional. No obstante hay que considerar el Programa de repatriación de científicos colombianos que Colciencias ha venido fomentando. Este programa se ha venido implementando hace tres años y en este lapso han regresado un poco más de 50 colombianos con título de doctorado para vincularse a instituciones universitarias, centros de investigación y en algunas empresas públicas y privadas.

Habría entonces que diferenciar dos estrategias de política con respecto a la Red Caldas. Una tendría que considerar la condiciones internas para la recepción e incorporación de los científi-

ficos y profesionales que ciertamente regresarán, seleccionando las condiciones más óptimas de vinculación al sistema de educación superior o con instituciones de investigación científica pues son estos espacios los más directamente implicados con le desarrollo de la ciencia y la tecnología nacionales. La segunda estrategia de política podría orientarse con mayor claridad hacia la consolidación de la Red de investigadores en el exterior - los que permanecerán indefinidamente -, con el ánimo de interesarlos en la necesidad de fortalecer el desarrollo científico nacional y encontrar con ellos modalidades deslocalizadas para estructurar el sistema de cooperación entre los grupos de investigación residentes en el país y los científicos expatriados. Los investigadores repatriados jugarían un papel dinamizador en este proceso puesto que no sólo regresan con una alta calificación sino con una trayectoria importante que les ha permitido obtener vínculos con la comunidad académica internacional.

La Red científica residente en el exterior

Podría afirmarse que el porcentaje de colombianos que permanecerán en el exterior es menor al que comunmente se cree. Sólo el 22 % de la población afirma que no regresará al país de manera permanente. Del total de la población encuestada sel 13.69 % de los individuos han obtenido segunda nacionalidad lo que permite vislumbrar una permanencia definitiva en esos paRses. La mayor parte de estos colombianos residen en Estados Unidos, ellos representan el 33.82 %, mientras que el 16.8 % en Francia, el 13.24 % en España y el 22.06 % en el resto de Europa. La mayor parte de estos individuos tienen contratos laborales permanentes en el exterior y han obtenido títulos doctorales. Este es el grupo que no tiene una intención segura de regresar al país y en esta perspectiva es el grupo de personas con el que habría que potenciar alianzas y modos de cooperación con la ciencia y la tecnología de Colombia. La cooperación científica que están haciendo estos investigadores ya se ha venido concretando gracias a que los colombianos residentes en el exterior ya habían constituido vínculos asociativos guiados por la solidaridad y la evocación de algunas costumbres colombianas. Antes de la constitución de la Red algunos colombianos ya se comunicaban a través de la redes de comunicación y organizaban encuentros sociales y culturales. Estos encuentros potenciaron, junto con el acceso a nuevas formas de comunicación, la emergencia de la Red Caldas que a instancias del gobierno colombiano vienen construyendo las condiciones para que ese potencial científico pueda asociarse a las estrategias de desarrollo científico y tecnológico nacional. En este caso la estrategia del gobierno colombiano no está explícitamente asociada a la necesidad de repatriar su potencial científico, como tradicionalmente se hace, sino que se consideran otros dispositivos de cooperación de manera deslocalizada ; ello implica considerar flujos de información, artRculos, encuentros académicos virtuales, realización de proyectos de investigación entre grupos distantes geográficamente y prestación de servicios, entre otras posibilidades.

Conclusiones

Buena parte de la literatura que ha abordado el fenómeno migratorio ha considerado particularmente dos perspectivas de análisis a lo largo del tiempo : Una asociada a la medición de los efectos económicos y políticos causados por la migración de personal altamente calificado tanto para los países de origen como para los países de destino. La segunda se ha venido refiriendo a la definición y aplicación de políticas selectivas para la atracción o desestímulo de los flujos internacionales de acuerdo con intereses estratégicos de cada país.

Otros estudios llaman la atención sobre la necesidad de aportar a la comprensión del fenómeno migratorio de científicos y profesionales otros elementos que influyen significativamente en la dinámica de estos flujos dejando atrás la noción simple de “fuga de talentos” vs “ganancia de talentos”. Ello implica empezar a considerar nuevas modalidades en las que fluye el conocimiento científico y que trasciende a la evidencia empírica de la movilidad de personas.

La política colombiana, al constituir la Red Caldas, ha sido la de estimular iniciativas científicas o de desarrollo tecnológico de los investigadores que residen en el exterior en asociación con grupos académicos nacionales. Esta política busca crear y consolidar vínculos de cooperación científica de manera deslocalizada.

Sin embargo habría que diferenciar por los menos dos tipos de política en lo que concierne a la Red Caldas. Una tendría que considerar la condiciones internas para la recepción e incorporación de los científicos y profesionales que regresan y seleccionar las condiciones más óptimas de vinculación al sistema de educación superior o con instituciones de investigación científica pues son estos espacios los más directamente implicados con le desarrollo de la ciencia y la tecnología nacionales. La segunda estrategia de política podría orientarse con mayor claridad hacia la consolidación de la Red de investigadores en el exterior con el ánimo de interesarlos en la necesidad de fortalecer el desarrollo científico nacional y encontrar con ellos modalidades deslocalizadas para estructurar el sistema de cooperación entre los grupos de investigación residentes en el país y los científicos expatriados.

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[1] Contrario a la consideración de que la migración laboral internacional es básicamente resultado de decisiones económicas orientadas por leyes de oferta y demanda, podría afirmarse que los flujos fueron originalmente sociales pero su evolución fue considerando cada vez más determinantes económicos.

[2] En este caso, los países receptores estimulan o desestimulan los flujos migratorios, considerando los ciclos de productividad económica. Los extranjeros pueden ser retenidos durante periodos limitados para alcanzar competitividad internacional e incrementar productividad.

[3] En los Estados Unidos la disponibilidad de visas para residencia permanente está reservada para profesionales de excepcional capacidad y mérito.

[4] Si la migración se da entre países de desigual desarrollo, esto muestra la consolidación asimétrica entre los mismos. Bajo esta consideración los países en desarrollo pierden capital humano. Esa pérdida puede cuantificarse y estimar su efecto sobre la reproducción de dicho capital.

[5] El análisis del caso colombiano, esta sustentado en el proyecto de investigación « El brain drain revisited a través del caso colombiano. La Red Caldas ». Dentro de este estudio se realizó la encuesta Redes Colombia de la cual se han inferido todos los datos estadísticos que aquí se presentan. El total de la población residente en el exterior que respondió a la encuesta es de 453 individuos.

[6] El análisis cuali-cuantitativo se realizó con base en estadísticas descriptivas y posteriormente se ejecutaron algunos análisis y clasificación a través del método de correspondencias simples.

[7] « Mientras las economías desarrolladas continúen siendo polos de atracción para el intercambio de personas altamente calificadas y en contraste los países pobres sigan teniendo rápido crecimiento poblacional y bajos estándares en los niveles de vida se fomentará la emigración en un sentido unívoco."

[8] En este caso se calcularon número de contratos laborales en el exterior sin tomar en consideraron vínculos laborales con Colombia, (Sin embargo éstos se estiman en un 40.7 % del total de contratos) ni el número de personas que han realizado estos contratos. En total se habían realizado 472 contratos laborales en el exterior.

[9] Esta clasificación se realizó con referencia a la "Base de données PASCAL plan de classement" y "FRANCIS" del INSTITUT DE L´INFORMATION SCIENTIFIQUE ET TECHNIQUE -INIST- de París. Este plan de clasificación tiene siete niveles, en el primero se presentan tres agregaciones generales que se subdividen hasta llegar a actividades muy particulares.

[10] Estas participaciones porcentuales se calculan sobre el total de contratos : 472.

[11] Se consideraron los segmentos de la encuesta : a) escolaridad alcanzada, b) Vínculo laboral actual y c) Actitud y expectativas de los individuos en sus relaciones de trabajo. Esta información fue tratada a través del método de correspondencias simples, para ello se utilizó el software SPADT. Los resultados estadísticos se presentan como agrupaciones de individuos que poseen características similares.

[12] La primera agrupación obtenida representa el 51.9 % de la población que ha alcanzado el título de doctorado y para los que su actividad laboral actual esta en el campo de la investigación.

[13] Más que considerar el cálculo individual por un óptimo ingreso como razón fundamental de los flujos migratorios puede considerarse que otras motivaciones hacen más fluida y compleja la migración posibilitando la formación de microestructuras que pueden consolidarse a través del tiempo, si se amplían, diversifican y se estabilizan las redes constituidas por múltiples intereses y alianzas entre individuos, grupos, instituciones y Estados.

[14] Carta de Colciencias (1993), 16 : 4, Santa Fe de Bogotá.

[15] Hasta 1993 el Programa Nacional de Recursos humanos para la Ciencia y la tecnología de Colciencias había otorgado 220 becas para cursos de doctorado, seis becas para post-doctorados y 15 cursos de entrenamiento corto. « los beneficiarios trabajarán al concluir su formación en actividades de investigación y desarrollo de tecnología en Colombia para condonar total o parcialmente sus créditos ». Carta de Colciencias, Vól 6, No 4, 1993, pág 7.

The Mobility of Human Capital from the Perspective of Latin American Science

Hebe Vessuri

The exploitation increasingly more intensive of scientific and technological research and the transnational cooperation are viewed today as essential elements to strengthen the bases of industry and competitiveness (CEU, 1993). The increasing mobility of researchers is a characteristic data of the dynamic of contemporaneous science. However, the flows are not equivalent but are marked biased. Especially when this subject is viewed from the perspective of a region with less absolute and relative development such as it is the case of Latin America, problems of a different type from those discussed in the more industrialized countries become evident. Particularly, it is possible to observe in a remarkable manner the effects of a fundamental aspect of the scientific/research profession and the professional training : the world has moved in the past two centuries and more intensively in the last two decades, in the direction of producing an “international professional”, which has implied a network of mutually recognized qualifications that pass through national and cultural boundaries. A North American or German scientist is not usually identified by the national nature of his activity but for the scientific discipline to which he belongs, be it chemistry, physics or mathematics. The problem of the responsibility to his nation and therefore the nature itself of his scientific activity is presented in a much more marked manner in the case of scientists of developing countries. In them the disjunctive “international” versus “national” has been experienced at different times as true antinomies and not as an element singularly characteristic of scientific research (Vessuri, 1991 ; 1993 ; 1995).

In most countries the profession of scientific research is closely integrated to this network of qualifications which characterizes the world’s scientific community : homophile, homogeneity, density, multiplexity and scope (Schott, 1993). International scientific associations have promoted the establishment of common standards and the reciprocal recognition of qualifications and have as one of their basic objectives overcoming the national cultural barriers (Godfrey, 1978). When the scientists travel it is supposed that they do it simply as scientists and not as Italian, Japanese or North American.

This has been achieved to a good extent through the location of the qualification, through the introduction and development of higher education and post-graduate education in an increasing number of institutions in countries without a scientific tradition. In these processes, scientists and higher education institution have sought that their qualifications be internationally recognized. Among the validation mechanisms have been the merit evaluation criteria based on publications with recognized impact indexes, the contacts with foreign researchers and institutions, and in general the desire to maintain “international” standards through the assumption of a “universe epistemologically shared”. It is assumed that such an “internationally qualified” professional can perform satisfactorily under “internationally standardized” conditions. At the present time those in charge of making scientific policy global tend to adopt as non problematic the efficient space, from which culture has been eliminated, inhabited by Research and International Development of economic policy.

Only that the world is never fully perfectly organized or homogenous. In fact, among the wide differences that are observed among scientists in the developing countries and in the industrialized countries are two important aspects in which the "social distances and the long geographic distances" resolve in different ways according to the policies of knowledge in effect, the cultural frameworks in which the particular scientific activity is located, the stages of the institutional development of science and the personal features of the scientists. Those aspects are, on the one hand, the needs for acquisition of resources -tangible and intangible- that their people have and, on the other, the absolute and relative shortage of available means to satisfy those needs, in cultural and political contexts which are threatened by the risk of losing the identity and legitimacy.

A lot has been written on the subject of development of scientific infrastructure and of the research capabilities adequate for the developing countries. However, the characteristics of the markets, the uneven distribution of income, the political-economic determination of knowledge and the dominant ideology combine to perpetuate a state of things that was conceived some time ago and according to which science's own development as an international social institution assumes *ab initio* the existence of a model of center and periphery, which assumes different features -structuring the scientific exchanges between metropolis and province (Inkster, 1983), between the source of the empire and its colonial locations (McLeod, 1987), between the economic centers and the underdeveloped peripheries (Salomon et al, 1994)- and expresses itself, among others, in the constant presence of the "brain drain". Let us see how this situation was conceived.

Establishment and Consolidation of International Patterns of Scientific Production

Paradoxically, in the 19th century, known as the European century since it was a time when Europe became the center of the world and when world history was formulated in European terms, that eminently European institution which is science took shape to a good extent measured by the inextinguishable production of new knowledge in the gigantic laboratory of non European peripheries. In fact, the social matrix of science which was built in that century corresponded to a social institution of international nature, characterized by multiple flows of different classes and directions, in which individuals, objects and ideas acquired a mobility without precedents.

On the European side, there was a symbiotic relationship between science and the forces of national expansion of England, France and Holland and the imperial development. Metropolitan scientists exploited successfully the increasing research opportunities created by the expansion of Europe overseas. Specifically, their activities contributed to the cultural consolidation and economic development of some of the most advanced colonies, to the administration and improvement of dependencies which were considered to lack the capacity for political independence, and to the exploration of land outside the formal area of control of the empires which commercial potential could be developed in coordination with the central economies, such as it was the case of the Latin American nations formally independent in the 19th century.

The career opportunities and the data offered by the new overseas worlds deeply influenced the development of scientific disciplines in Europe. European scientists exported their knowledge to the rest of the world, where it progressed as resources of intelligence and motors of economic development. As with other professional groups, the wish to establish secure career struc-

tures encouraged scientists to look for their quota of public, social and economic power, pressing to obtain the recognition of the applicability of their disciplines to a wide range of technical and social problems. Almost every time they were associated with the *how, where* and *why* of the key sectors of the infrastructure of the new overseas societies. In the sugar cane plantations, the railroad, the mines and the port facilities that were installed in different regions of Latin America in order to exploit the natural resources that in each stage were increasing in value in the expanding European markets, very frequently the footprint of European scientists and engineers who acted in technical and management functions remained.

One of the first organized technical bodies that participated in the development of the new continent was that of Spanish military engineers (Capel, H., J.E. Sanchez, and O. Moncada, 1988). Because of the low total number of its members and thus of the individuals that were in conditions to move to America during the 18th Century, in the same entity were admitted as Spaniards, Irish, Flemish, Italian or French engineers. Once they were intended to America, where they have to live a minimum of five years before requesting a license or the return to the peninsula, the engineers obtained the automatic promotion to a higher category. In any event, in the last quarter of the 18th century, the Spanish group of military engineers already had in America a large number and with a very high technical and scientific level. In New Spain, from 1768 to 1800 there were 67 military engineers working or assigned there, 39 in Colombia, 35 in Cuba ; Chile had 25, while Argentina had 23, Guatemala 14, Philippines 10 and Florida 8.

As for the new overseas societies, the scientific and economic dada produced there were routed to the European centers with the enthusiastic cooperation from the same peripheries. They restlessly sought to be accepted as new independent members within the concert of sovereign nations, confirming their independence and their “civilized” nature. Countries anxious to confirm their status were forced to used European scientists and engineers to make the cartographic surveys in their territory. Likewise, foreign capitalists were only convinced to invest in development schemes researched and certified by those experts. Already at the beginning of the 19th century, Humboldt wanted to draw the attention of European capitalists towards the huge mineral resources of Mexico, especially the silver mines, which in his opinion could bring great benefits if they were properly exploited. His book *Essai politique sur le royaume de la Nouvelle-Espagne* was very quickly translated into English and was the immediate cause for the Mexican mining industry to fall under British control in the years following the independence. Several companies were founded in London to acquire and exploit the mines and the shares of stock increased to absurd levels, disregarding the fact that many mines had been flooded during the Mexican revolution and required large capital injections in order to be exploited again.

The production of maps of any portion of the world had to be ratified either in London, Paris or Berlin. The best maps were made available to the international public through their acceptance and validation in Europe. Because the maps encoded large amounts of scientific, strategic and commercial intelligence in a graphic form easily understandable, they symbolized power and progress. Their possession permitted the great powers to coordinate administrative, development and defense activities, monitor those of their rivals and organize the exploitation of peripheral resources. Unavoidably, the sovereign nations of Latin America were drawn under the domain of European cartography. Thus, Codazzi was forced to travel to Paris prior to the publication of his work on The Cartography in Venezuela in 1841, in order to present it to the consideration of the commissioners of the Paris Geography Society, and the same was done by other active cartographers in Latin America and other peripheries.

The election of scientists to be in charge of organizing the exhibition of national wealth in the international shows that were increasingly more frequent a the 19th century advanced, illustrates the fact that already in the middle of the century the scientists had obtained social recognition as the proper representatives of the economic interests of the new Latin American

nations. The new Latin American nations and colonies anxious to attract immigrants and capital investments founded geological missions during the 19th century to discover and evaluate their mineral resources and obtain the data necessary that would regulate their private exploitation, using the metropolitan scientific societies as the place to make public the available resources in their countries. The prominence of natural resources in the new scenarios, served to put under state control and organize in accordance with the metropolitan formula, the research by amateurs already started in many cases by members or correspondents of European scientific societies.

At the same time, it was not less significant that the metropolitan scientific societies, by being the center for the publication and validation of the work by the scientists of the new countries lacking a scientific tradition, would serve as monitoring mechanisms through which the European wise men collected new data that they gradually incorporated to their own synthetic theories. The typical scheme of the work organization adopted by the European scientific societies for cooperative research, consisting of the combination of academics located in the metropolis and provincial or colonial data collectors was thus perpetuated at an international scale. The efforts by the field workers in the different regions of the world helped to maintain the predominance of the scientific elite of London, Paris or Berlin. The dominant influence of the scientific societies of Europe in the honors, publication privileges, purchase of fossils and other specimens for public museums, sale of books and reputation in general represented an indirect system of control which, together with the official patronage by the missions, botanical and geological expeditions and academic appointments, subordinated in an effective manner the overseas science to the European metropolis. The lines of scientific authority were thus parallel to the political authority during a great part of the 19th century.

In the new independent Latin American states, the growth of scientific institutions became an important part of the national construction process. Throughout the 19th century and the first decades of the 20th century, European science, in its national versions, accommodated to the self-determination expectations in that non European world through a policy of relative assimilation intended to consolidate the metropolitan domain. The support to the incorporation of Latin American members to some metropolitan scientific societies was part of the attempts to endorse possible new intellectual leaderships removing obstacles that threatened with the eventual disruption of the established political and cultural arrangement. In such arrangement the scientists, both metropolitan and from overseas, engaged in the unification of the theory and practice, committed to the transformation of the physical world of compatible forms with the interest of the social needs perceived.

The metropolitan perceptions of the periphery were mediated by European personalities that controlled the flow of information that reached the European public. The central position of some of those personalities turned them into barrier guards that either caused the advance or blocked the possibilities of making a career to individuals interested in the scientific activity of the peripheries. Several modalities of sponsorships took part in the exchange between centers and peripheries, but all of them had in common the fact that the unknown scientist from a far away place could not have a direct entrance to the collegiate circle of the “international” scientific community until his efforts in the periphery could be translated into the language and interests of the central community (Raine, 1996). Historic evidence suggests that these people tended to use their authority to demand conformity. In this respect they were functional to their government, establishing the foundations of popularity and prestige of their scientific disciplines and of the European scientific societies of which they were members because of their capacity to exchange practical and provide scientific heroes useful to the expansive dynamic of their societies. (Such is the paradigmatic case of Sir Roderick Murchison, analyzed by Stafford, 1992). By promoting the exploration, the recognition of natural resources, the commercial expansion and the development and imperial security, Murchison systematically

encouraged the exploitation of the British empire and of all the peripheries. By mediating the resulting information flow that reached the British public, it also played a significant role of definition of the metropolitan perceptions of those regions of the world.

In general, scientists from far away latitudes appreciated the sponsorship and the invaluable services of those intermediaries to strengthen their aims for public recognition. Notwithstanding this, in the peripheries, which scientists represented a mixed lot of natives, Germans, British, French, Spaniards, Italian, Belgians and individuals of other nationalities, practitioners with a metropolitan status or with pretensions for greater recognition and who felt that their reputation and research were betrayed by mediators in/from the metropolis rebelled quite a few times against such a metropolitan autocracy. Historic records keep frequent testimonies of resentment for this cause. In Latin America are well known the difficulties of the Argentinean paleontologist Florentino Ameghino with the German zoologist Hermann Burmeiister, of outstanding experience in South America in the second half of the 19th century (Vessuri, 1994); or the problem of adapting the European operation levels to the Latin American institutions, sometimes complicated by the arrogance of some European experts, as it was the case of Bernard Lewy, chemistry professor and director of the new institute of sciences of Bogota, described by Safford (1976). Although most of the European instructors and scientists that came to America worked with patience and dedication, there is no doubt that the interests of the two groups were frequently different as there were also differences in the orientation of values between the members of national elites with respect to science. The truth is that in the histories of individual successes and failures of Latin American scientists usually there is the figure of a European instructor or benefactor who introduces the Latin American researcher to his European peers.

Naturally, individual scientists not necessarily acted in accordance with a utilitarian logic. The persistent strength of the tradition of amateur natural history which for a long time was associated to hegemonic culture, was combined with the domain of the economic doctrine of laissez-faire determining that the science of the 19th century were to a good extent sponsored and managed on a voluntary basis. However, it seems clear that the scientists/soldiers or scientists/politician turned out to be multi-functional, using knowledge, in the sentence by Steven Shapin, not only for the “prediction and control of phenomena” but simultaneously “to legitimate structures in the widest society”. By serving European governments in both levels, they helped to make of science an instrument of the State.

In the 19th century, both in Europe and in the peripheries the utilitarian ethics prevailed, combined with the element of patriotism which was associated in one case to the expansionist fervor and in the other to the independentist passion. As science and patriotism supplanted the traditional Christian belief in the creed of nations, this symbiosis became a singularly appropriate theology for the era that witnessed the rise of modern capitalism and the state-nation as its political expression. The internationalism inherent to science as an epistemological and axiologic value was combined with the national prestige that was increasingly acquired by French, English and German science. In the assumption that the scientist was a member of the “republic of the science”, a citizen of the world, his contributions to the international and universal heritage of science were assumed to be independent from national frontiers. In the exportation of the pasteurism to the tropics and even worldwide, its members defended the existence of a “pasteurian science”, i.e. a paradox kind of science, universal in scope and objectives but, notwithstanding that, implicitly French, which included the commitment to the theory of the germs of the disease, the implementation of new bacteriological techniques, and a fresh view of the field epidemiology (Moulin, 1992). The 19th century was known as the century of “basic”, “pure”, “fundamental” science separated from the “impure” results of technology and even of applied science. Although the peripheries and colonies contributed substantially to the advance of “basic” science, already from an early stage of the configuration of the international scientific order they were connected to the activities of application of results.

Scientific Mobility in the Contemporaneous World and the Dilemma of Latin American Science

At the end of the 20th century, in another turn of history, the market opportunities seem to have taken the place of patriotism as the most recent creed in a world dominated by a recently coined control, that of the multinational corporations. Contemporaneous science has changed its identity with respect to the science of the end of the 20th century. In it the technical aspects are increasingly emphasized and as the techniques proliferate, they lead to the fragmentation of knowledge in small fields that are intensively harvested. With variable intensity depending on the respective discipline and specialty, an increase is observed of the formal and informal networks for communication with distant colleagues, to access remote data bases and distribute the results of the research, associated to an increasing academic mobility.

In the most recent process of globalization of the markets, not only the capital flows become more intensive, to the extent that the ability of the nation-state to protect the interests and well being of its citizens is questioned, but also the flows of human capital start to assume a volatility similar to that of their financial counterpart. In the process of merging the national markets in a worldwide version of the market, human capital would follow the financial capital to those regions where it is more concentrated. Thus, the mobility of human capital would be located in the heart of globalization.

To the extent that the implications of this globalization process start to change the way how we perceive our own societies and their place in this new order, they force us also to review the image produced by the history and sociology of science about the process of incorporation of national scientific societies in Latin America and the perception of the "scientific mobility" and "brain drain" in those communities. The conventional view consists of an explanation or narrative of the growth of scientific communities nourished throughout history with natives and flows of scientific migrants coming from other regions. The result was usually understood as a demographic equation that could be verified through the institutionalization of the scientific disciplines of the region. The basic assumption has been that from the flows of people and ideas resulted national science cultures or at least local scientific traditions.

At different times during this century there was a growth of the anti-imperialistic and nationalist positions, which accompanying the development of urban middle and working classes, served as promoting forces for the movements that sought a more autonomous redefinition of the national identity in its various expressions. The national and social issues were entangled in a complex equation which was used by history to challenge politicians and intellectuals in the most varied contexts, from the literary pages, passing through the political tribune up to and in a less noticeable manner, the facilities of the scientific laboratory (Vessuri, 1991 ; 1990). At the end of the 20th century, however, notwithstanding the multiplication of nationalisms, ethnic identities and regionalisms in the antipodes of the universalistic statements with which science has been typically associated, it becomes clear that such movements were not able to change the world's economic and political order and the hierarchical structure of the international scientific organization.

Up to the decade of 1960 the educational and scientific international cooperation in the Latin American region was characterized by a high degree of congruence between the policies of industrialized donating countries and the "needs" articulated by the receivers of the developing countries. Influential studies of that time (i.e. Schutz, 1963), showed the effects of the productivity increase of the investments in education, revealing that the extent of the effects grew according to the educational level. With more than one similarity of the processes of affiliation of colonial institutions with metropolitan institutions in the 19th century, a number of univer-

sities and agencies of industrialized countries were involved in building institutions and programs in the region.

But frequently the results were not up to the promise contained in the international technocratic rhetoric and many countries suffered the disenchantment of seeing that education and science were not the panacea that they expected and became quite a few times in a significant part of the problem. Their graduates were "functional", by their expectations and needs, for developed social contexts and not for those in which they normally had to perform. The failure to become endogenous was expressed, among others, in the so many times mentioned "social relevance" of the Latin American university institution. The economic crisis that affected most of the Latin American countries in the decade of the '80s increased even more the difficulties of scientific research. Notwithstanding that in Latin America already there are institutional *loci* for science "with conditions for forming researchers as good or as bad as those of the first world, they operate in cultural contexts that continue without preparation to admit modern scientific-technical-productive apparatus" (Cereijido, 1994).

The search for relative autonomy that characterized Latin American theoretical statements of the '60s seeking for development means which were an alternative to the dominant means is criticized today as naive and the myth of the economic globalization is embraced. However, in the practice scientific research still continues to be to a good extent an activity that is financed within the national framework and is carried out within institutions located in particular contexts, and still more, is identified with specific laboratories, as it has been shown by the constructionist literature on microsociology of science (Latour & Woolgar, 197 ; Knorr Cetina, 1981).

It is under these contexts that today the issue of "brain drain" in the region is presented again, under the conviction shared by several commentators on the status of Latin American scientific activity, that relatively significant numbers of scientists and engineers are abandoning some countries of the region. This conviction reflects a particularly significant anxiety since it occurs after fifty years of modernization and development efforts on the part of the State and the civil society, in which science and technology frequently appeared indicated as critical components of such efforts. In fact, the systematic quantitative evidence on the subject is variable and the depth of the reflection on its meaning and implications is also variable. It turns out superficially attractive to see the emigration as a symbolic expression of a verdict on governmental policies. In the decade of the '80s Great Britain experienced a noticeable increase of emigration of its scientists abroad, especially the United States, and that was taken as a massive response to the policy of the Thatcher administration (SEPSU, 1987).

A politically effective symbol must be emotional and simple. Emigration is in fact emotional ; but it does not take long to realize that it is not a simple phenomenon (Collins, 1988). Sometimes it can be simply the absence of State policies which makes a scientist feel an orphan of support and social demand for his work. Other times it is the perception of the curtailing of the research independence for excesses of political, economic or ideological pressures. There is an important individual component with respect to the decisions that have an influence on the way that a scientific career is pursued. But whatever the causes or motivations, definitely there are not differences between short term and longer term movements, more properly called migrations.

Short term movements between centers and nations by researchers have become fundamental to the normal research activity and there are many schemes to promote them. To this type of movements refer the academic mobility programs such as those of the European Union and, in our region, those of the Group of Montevideo and of various disciplinary academic networks. That movement is promoted by scientific communities and public powers. It is held that the open mobility, without barriers, is what science needs at the present, thus the public policies of developed countries that encourage such mobility. Under this perspective, the danger would be given by the non circulation, the construction of barriers to avoid the free circulation. The risk

would be similar to that of the regulations for protection of the market that many times prevented the participation by local industries in the dynamism of the international technological innovation.

It has been observed that these short term trips or movements (conventionally by short term is understood a stay abroad of up to three years) serve for the scientists to reduce the restrictions that they experience in their research activity. Research careers are limited by lack of funds (specially untied funds), lack of access to equipment, other demands on the time of the scientist, challenges by competing groups, the need to work in accordance with an approved or generally accepted manner and insufficient credibility to obtain that their ideas or proposals be accepted (Carlson & Martin-Rovet, 1995). Whether he works on marginal subjects or not, a scientist may be benefited from the differences in the work environment because the weaknesses of a system may be less restrictive for an outsider. In any event, what is convenient for a scientist is whatever will strengthen his credibility and authority. Mobility is useful for the achievement of this objective. It is a way to favor, although temporarily or partially, the cooperation and the communality, at the same time that it may permit the scientist to acquire a competitive vein upon his return to his customary work place.

Under this conceptualization of the problem, it is only the long term emigration which should cause any anxieties about a "brain drain", and in such a case only under certain conditions. However, when the process is observed in detailed, it is not simple to distinguish long term migration from short term migration. It becomes necessary to make comparisons in time, taking into account the length of the periods of stay abroad. The anxiety increases in countries such as those of Latin America for the recognition of the weaknesses of institutional and social contexts which should reabsorb the scientists that go abroad to perform specific scientific duties, either in their postgraduate education or for supposedly shorter stays for scientific exchange in an intermediate stage of their careers. In more than one respect such anxiety would seem to be linked to the recognition that the nature of the scientific professions and the education of researchers entails a predisposition for emigration, since their formation and experience becomes to a good extent irrelevant for local work markets and, to the contrary, is directly functional for the labour markets of developed centers.

Therefore, for the characterization of the phenomenon it is not sufficient to consider the number of emigrants, or analyze how long do they stay in their new countries and whether they eventually return. It is necessary to consider also the contents and quality of their education, the age and experience of the emigrants, their family characteristics, the reasons why they move, the characteristics of the national system of scientific research, the industrialization pattern, the State's promotional policies, the international relations, etc. It is also necessary to take into consideration the changing tendencies in time as the conditions of the country of origin and of the countries of destination change. And together with the data on emigrants, data on the immigrations received by the same country should be collected. Most of the literature on migrations, including that by scientists deals on the subject under the assumption that migrants move by a forced need, which is not necessarily the case, particularly in the case of scientists if we accept that the dynamics of mobility is at the base of the career. Scientists may migrate to strengthen their "international" credentials or to give a way out to marginal ideas and centrifugal forces that do not find an acceptance in their local media. But even with all data, we would still be left with interpretation problems.

In fact, the existence of a changing hierarchy of places in the world that offer combinations of specific factors is observed, some of which favor the receipt and others the expulsion of scientists. At the present time there is not one center but a variety of centers of varied weights and influences with vectors that point to different directions. Even so, there are centers of centers and the United States continues utional and disciplinary centers that are attractive because they maintain high standards, concentrate resources and are capable of giving scientific information,

access to equipment and credentials useful for the scientists of the periphery. Latin America seems to be condemned to continue producing scientists to fill its expectations and needs as a society and to be able to have the opportunity that its citizens will develop their cultural, intellectual and scientific potential. As a region and within it, the countries that make up the region risk losing a considerable part of those scientists in the way until they achieve the creation of more favorable conditions for the scientific enterprise, but the alternative would simply be not being, thus abandoning the development of the capabilities. It is just here where the excessively intrusive nature of the dominant "international" model may force to lose sight of the ideas about what kind of science or what means for what purposes would be the most useful for the problems of these regions. Under the perspective of an "international" science without frontiers, the periphery ceases to have sense by being included in the centralized monolithic model of global competition. To the contrary, under the perspective of history of Latin American science it is observed that the latter does not work exactly as the multinational corporations of research and development but there is a wide range of localized, major and minor, contributions to the mosaic of science and that the periphery may be more innovating that the centers since they have very strong investments to maintain. Thus, notwithstanding that science as a basis of industrial development becomes increasingly homogeneous and that there is an easy harmony between the model of central science and the dominant economic policies, there is still a margin for maneuvering in order to orient the results of the peripheral science to original directions. The mobility of scientists, also in these cases, may serve to understand better, to become more conscious about the unknown and to put under a more proper perspective the valid and original projects of the periphery connecting local efforts.

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La movilidad científica desde la perspectiva de América Latina

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La explotación cada vez más intensa de la investigación científica y tecnológica y la cooperación transnacional son vistas hoy como elementos esenciales para fortalecer las bases de la industria y la competitividad (CEU, 1993). La movilidad creciente de los investigadores es un dato característico de la dinámica de la ciencia contemporánea. Sin embargo, los flujos no son equivalentes sino que están marcadamente sesgados. Especialmente cuando este tema es visto desde la perspectiva de una región de menor desarrollo absoluto y relativo como lo es la latinoamericana, se ponen en evidencia problemas de orden diferente a los que se discuten en los países más industrializados. En particular, se pueden apreciar de manera singular los efectos de un aspecto fundamental de la profesión científica/investigativa y el adiestramiento profesional : el mundo se ha movido en los últimos dos siglos, y más intensamente en las últimas décadas, en la dirección de producir un "profesional internacional", lo que ha implicado una red de calificaciones mutuamente reconocidas que atraviesan las fronteras nacionales y culturales. Un científico norteamericano o alemán no suele identificarse por la índole nacional de su actividad sino por la disciplina científica a la que pertenece, sea esta química, física o matemática. El problema de la responsabilidad para con su nación y por tanto la misma índole de su quehacer científico se plantea de manera mucho más marcada en el caso de los científicos de los países en desarrollo. En ellos la disyuntiva "internacional" versus "nacional" se ha vivido en distintos momentos como verdaderas antinomias y no como un elemento singularmente característico de la investigación científica (Vessuri, 1991 ; 1993 ; 1995).

En la mayoría de los países la profesión de la investigación científica, está estrechamente integrada a esa red de calificaciones que caracteriza a la comunidad científica global : homofilia, homogeneidad, densidad, multiplexidad y alcance (Schott, 1993). Las asociaciones científicas internacionales han promovido el establecimiento de estándares comunes y el reconocimiento recíproco de calificaciones, y tienen como uno de sus objetivos básicos la superación de las barreras culturales nacionales (Godfrey, 1978). Cuando los científicos viajan se supone que lo hacen simplemente como científicos y no como italianos, japoneses o norteamericanos.

Esto se ha logrado en buena medida por medio de la localización de las calificaciones, a través de la implantación y desarrollo de programas de educación superior y postgrado en un número creciente de instituciones en países sin tradición científica. En esos procesos, los científicos e instituciones de educación superior han buscado que sus calificaciones sean internacionalmente reconocidas. Entre los mecanismos de validación han estado los criterios de evaluación del mérito basados en las publicaciones con índices de impacto reconocido, los contactos con investigadores e instituciones extranjeras, y en general el deseo de mantener estándares "internacionales", a través del supuesto de un "universo epistemológicamente compartido". Se supone que ese profesional "internacionalmente calificado" puede desenvolverse satisfactoriamente en condiciones "internacionales estandarizadas." En el presente los globalizadores en el campo de la política científica tienden a adoptar como no problemático el espacio eficiente, del cual la cultura ha sido eliminada, habitado por la Investigación y el Desarrollo internacional de la política económica.

Sólo que el mundo no acaba de estar perfectamente organizado ni es homogéneo. De hecho, entre las grandes diferencias que se observan entre los científicos en los países en desarrollo y

en los industrializados están dos aspectos importantes en los que las "distancias sociales y las largas distancias geográficas" se resuelven de distintas maneras según las políticas del conocimiento vigentes, los marcos culturales en los que la actividad científica particular se encuentra localizada, las etapas del desarrollo institucional de la ciencia y los rasgos personales de los científicos. Esos aspectos son, por un lado, las necesidades de adquisición de recursos -tangibles e intangibles- que tienen sus pueblos y, por el otro, la escasez absoluta y relativa de medios disponibles para satisfacer esas necesidades, en contextos culturales y políticos que se ven amenzados por el riesgo de pérdida de la identidad y legitimidad.

Se ha escrito mucho sobre el tema del desarrollo de la infraestructura científica y de las capacidades de investigación adecuadas a los países en desarrollo. No obstante, las características de los mercados, la distribución desigual del ingreso, la determinación político-económica del conocimiento y la ideología dominante se combinan para perpetuar un estado de cosas que se gestó hace tiempo y según el cual el propio desarrollo de la ciencia como institución social internacional supone ab initio la existencia de un modelo de centro y periferia, que asume diferentes rasgos -estructurando los intercambios científicos entre metrópolis y provincia (Inkster, 1983), entre la fuente del imperio y sus puestos coloniales (McLeod, 1987), entre los centros económicos y las periferias subdesarrolladas (Salomon et al, 1994)-, y se expresa, entre otros, en la presencia constante de la "fuga de talentos". Veamos cómo es que se gestó esta situación.

Establecimiento y consolidación de patrones internacionales de producción científica

Paradójicamente, en el siglo XIX, conocido como el siglo europeo pues fue una época en la cual Europa se convirtió en el centro del mundo y cuando la historia mundial llegó a formularse en términos europeos, esa institución eminentemente europea que es la ciencia cobraba forma en buena medida por la producción inagotable de nuevo conocimiento en el laboratorio gigantesco de las periferias no europeas. De hecho, la matriz social de la ciencia que se constituyó en ese siglo correspondió a una institución social de naturaleza transnacional caracterizada por múltiples flujos de diferentes clases y direcciones, en las que individuos, objetos e ideas adquirieron una movilidad sin precedentes.

Del lado europeo, hubo una relación simbiótica entre la ciencia y las fuerzas de la expansión nacional de Inglaterra, Francia y Holanda y el desarrollo imperial. Los científicos metropolitanos explotaron con éxito las oportunidades crecientes de investigación creadas por la expansión de Europa en ultramar. Específicamente, sus actividades contribuyeron a la consolidación cultural y desarrollo económico de algunas de las colonias más avanzadas, a la administración y el mejoramiento de dependencias que se consideraba que carecían de capacidad para la independiencia política, y a la exploración de territorios fuera del área de control formal de los imperios cuyo potencial comercial podía desarrollarse en coordinación con las economías centrales, como fue el caso de las naciones latinoamericanas formalmente independientes en el siglo XIX.

Las oportunidades de carrera y los datos que ofrecían los nuevos mundos ultramarinos influenciaron profundamente el desarrollo de las disciplinas científicas en Europa. Los científicos europeos exportaron sus saberes al resto del mundo, donde prosperaron como recursos de inteligencia y motores del desarrollo económico. Como con otros grupos profesionales, el deseo de establecer estructuras de carrera seguras impulsó a los científicos a buscar su cuota de poder político, social y económico, presionando para obtener el reconocimiento de la aplicabilidad de sus disciplinas a una amplia gama de problemas técnicos y sociales. Casi siempre estuvieron

asociados con el cuándo, el dónde y el por qué de sectores claves de la infraestructura de las nuevas sociedades ultramarina. En las plantaciones cañeras, los ferrocarriles, las minas y las facilidades portuarias que se instalaron en diferentes regiones de América Latina para explotar los recursos naturales que en cada etapa se valorizaron en los mercados europeos en expansión, con frecuencia quedó la impronta de científicos e ingenieros europeos que actuaron en funciones técnicas y de gestión.

Uno de los primeros cuerpos técnicos organizados que participaron en el desarrollo del nuevo continente fue el de los ingenieros militares españoles (Capel, H., J.E.Sánchez y O. Moncada, 1988). Dado el reducido número total del mismo y por ende de los individuos que estuvieron en condiciones de trasladarse a América durante el siglo XVIII, en el mismo cuerpo fueron admitidos como españoles ingenieros irlandeses, flamencos, italianos o franceses. Una vez que eran destinados a América, donde tenían que residir un mínimo de cinco años antes de solicitar licencia o pedir el retorno a la península, los ingenieros obtenían la promoción automática a la categoría superior. En todo caso, en el último cuarto del siglo XVIII, el cuerpo de ingenieros militares español tenía ya en América un plantel numeroso y de muy alto nivel técnico-científico. En Nueva España, entre 1768 y 1800 trabajaron o estuvieron destinados 67 ingenieros militares, en Colombia 39, en Cuba 35; Chile contó con 25, mientras que Argentina tuvo 23, Guatemala 14, Filipinas 10 y Florida 8.

Del lado de las nuevas sociedades ultramarinas, los datos científicos y económicos allí producidos se canalizaron hacia los centros europeos con la colaboración entusiasta de las mismas periferias. Ellas buscaron sin descanso ser aceptadas como nuevos miembros independientes en el concierto de las naciones soberanas, afirmando su independencia y su naturaleza “civilizada”. Países ansiosos de afirmar su status eran obligados a emplear a científicos e ingenieros europeos para hacer los levantamientos cartográficos de su territorio. De manera similar, los capitalistas extranjeros sólo se convencían de invertir en esquemas de desarrollo investigados y certificados por tales expertos. Ya al iniciar el siglo XIX Humboldt quiso llamar la atención de los capitalistas europeos hacia los inmensos recursos minerales de México, sobre todo las minas de plata, que en su opinión podían rendir enormes beneficios si se explotaban adecuadamente. Su *libro Essai politique sur le royaume de la Nouvelle-Espagne* se tradujo rápidamente al inglés y fue la causa inmediata de que la industria minera mexicana cayera bajo control británico en los años que siguieron a la independencia. Se fundaron varias compañías en Londres para adquirir y explotar las minas y las acciones de bolsa se elevaron a unos niveles absurdos, sin reparar en el hecho de que muchas minas habían sido inundadas durante la revolución mexicana y requerían cuantiosas inyecciones de capital para poder ser explotadas nuevamente.

La producción de mapas de cualquier porción del mundo tenía que ser ratificada ya sea en Londres, Paris o Berlín. Los mejores mapas se hacían disponibles al público internacional a través de su aceptación y validación en Europa. Porque codificaban vastas cantidades de inteligencia científica, estratégica y comercial en una representación gráfica fácilmente asimilable, los mapas simbolizaban poder y progreso. Su posesión permitió a los grandes poderes coordinar sus actividades administrativas, de desarrollo y defensivas, monitorear las de sus rivales y organizar la explotación de recursos periféricos. Inevitablemente, las naciones soberanas de América Latina se vieron arrastradas al ámbito de dominación de la cartografía europea. Así fue como Codazzi tuvo que viajar a Paris previo a la publicación de su obra sobre *La Geografía en Venezuela* en 1841, para presentarla a la consideración de los comisionados de la Sociedad de Geografía de París, y lo mismo hicieron otros cartógrados activos en América Latina y otras periferias.

La elección de científicos como encargados de organizar la exhibición de las riquezas nacionales en las exposiciones internacionales que se hicieron cada vez más frecuentes a medida que avanzó el siglo XIX, ilustra el hecho que ya a mediados de siglo los científicos habían alcanzado el reconocimiento social como representantes apropiados de los intereses económicos de las nuevas naciones latinoamericanas Las nuevas naciones latinoamericanas y colonias ansio-

sas de atraer inmigrantes e inversiones de capital fundaron misiones geológicas durante el siglo XIX para descubrir y evaluar sus recursos minerales y obtener los datos necesarios que regularan su explotación privada, usando las sociedades científicas metropolitanas como el lugar para dar publicidad a los recursos disponibles en sus países. Los relevamientos de recursos naturales en los nuevos escenarios sirvieron para poner bajo control estatal y organizar de acuerdo con la fórmula metropolitana la investigación de aficionados ya iniciada en muchos casos por miembros o corresponsales de las sociedades científicas europeas.

Al mismo tiempo, no fue menos significativo que las sociedades científicas metropolitanas, al ser los focos para la publicación y validación del trabajo de los científicos de los nuevos países carentes de tradición científica, sirvieran como mecanismos de monitoreo por medio de los cuales los sabios europeos captaron nuevos datos que fueron incorporando a sus propias teorías sintéticas. El esquema típico de la organización del trabajo adoptado por las sociedades científicas europeas para la investigación cooperativa, consistente en la combinación de teóricos ubicados en las metrópolis y recolectores de datos provincianos o coloniales se perpetuó de esa manera en una escala internacional. Los esfuerzos de trabajadores de campo en las diferentes regiones del mundo ayudaron a mantener la ascendencia de las élites científicas de Londres, París o Berlín. La influencia dominante de las sociedades científicas de Europa en los honores, privilegios de publicación, compras de fósiles y otros especímenes para museos públicos, venta de libros y reputación en general constituyó un sistema indirecto de control que, junto con el patronazgo oficial de las misiones, expediciones botánicas y geológicas y nombramientos académicos, subordinó efectivamente la ciencia ultramarina a las metrópolis europeas. Las líneas de la autoridad científica fueron así paralelas a las de la autoridad política durante gran parte del siglo XIX.

En los nuevos estados independientes latinoamericanos, el crecimiento de instituciones científicas se convirtió en una parte importante del proceso de construcción nacional. A lo largo del siglo XIX y en las primeras décadas del siglo XX, la ciencia europea, en sus versiones nacionales, se acomodó a las aspiraciones de autodeterminación en ese mundo no europeo mediante una política de asimilación relativa dirigida a consolidar el dominio metropolitano. El auspicio de la incorporación de miembros latinoamericanos en algunas sociedades científicas metropolitanas fue parte de los intentos para cooptar posibles nuevos liderazgos intelectuales limando asperezas que amenazaran con la eventual ruptura del orden político-cultural establecido. En dicho orden los científicos, metropolitanos y ultramarinos, se ocuparon de la unificación de la teoría y práctica, comprometidos en transformar el mundo físico de formas compatibles con los intereses de las necesidades sociales percibidas.

Las percepciones metropolitanas de la periferia estuvieron mediatizadas por figuras europeas que controlaban el flujo de información que llegaba a los públicos europeos. La posición central de algunas de esas figuras las convirtió en guardabarreras que hacían avanzar o bloqueaban las posibilidades de hacer una carrera a individuos interesados en la actividad científica en las periferias. Varias modalidades de patronazgo mediaron los intercambios entre centros y periferias, pero todas tenían en común el hecho que el científico desconocido de un rincón recóndito no podía obtener entrada directa al círculo colegiado de la comunidad científica "internacional" hasta que sus esfuerzos en la periferia pudieran ser traducidos en el lenguaje e intereses de esa comunidad central (Raina, 1996). La evidencia histórica sugiere que estas personas tendieron a usar su autoridad para exigir conformidad. En esto eran funcionales a sus gobiernos, cimentando la popularidad y prestigio de sus disciplinas científicas y de las sociedades científicas europeas a la que estaban asociados por su capacidad de intercambiar resultados prácticos y de proveer héroes científicos útiles a las dinámicas expansivas de sus sociedades. Tal es el caso paradigmático de Sir Roderick Murchison, analizado por Stafford, 1992). Al promover la exploración, el reconocimiento de recursos naturales, la expansión comercial y el desarrollo y la seguridad imperial, Murchison estimuló sistemáticamente la explotación del imperio británico y de todas las periferias. Intermediando el flujo resultante de información que llegaba al público británico, también jugó un papel significativo de definición de las percepciones metropolitanas de esas regiones del mundo.

En general, los científicos extralatitudinales apreciaron el patronazgo y los invalorables servicios de esos intermediarios para fortalecer sus pretensiones de reconocimiento público. No obstante ello, en las periferias, cuyos científicos constituían un lote mezclado de nativos, alemanes, británicos, franceses, españoles, italianos, belgas e individuos de otras nacionalidades, los practicantes de estatura metropolitana o con pretensiones de mayor reconocimiento y que sentían que su reputación e investigación eran traicionadas por mediadores en/de las metrópolis se rebelaron no pocas veces contra esa autocracia metropolitana. El registro histórico conserva frecuentes testimonios de resentimientos por esta causa. En América Latina son conocidas las dificultades del paleontólogo argentino Florentino Ameghino con el zoólogo aleman Hermann Burmeister, de destacada trayectoria en América del Sur en la segunda mitad del siglo XIX (Vessuri, 1994); o el problema de adaptar los niveles de operación europeos a las instituciones latinoamericanas, complicado a veces por la arrogancia de algunos de los expertos europeos, como fue el caso de Bernard Lewy, profesor de química y director del nuevo instituto de ciencias de Bogotá, que describeSafford (1976). Si bien la mayoría de los instructores y científicos europeos que vinieron a América trabajaron con paciencia y dedicación es indudable que los intereses de los dos grupos con frecuencia eran divergentes así como también había divergencias en la orientación de valores entre los miembros de las élites nacionales respecto a la ciencia. Lo cierto es que en las historias de éxitos y fracasos individuales de científicos latinoamericanos casi siempre aparece la figura de un patrón o mecenas europeo que introduce al investigador latinoamericano a sus pares europeos.

Por supuesto, no necesariamente los científicos individuales actuaban de acuerdo con una lógica utilitaria. La fuerza persistente de la tradición de historia natural aficionada que por largo tiempo estuvo asociada con la cultura hegemónica, se combinó con el dominio de la doctrina económica del laissez-faire determinando que la ciencia del siglo XIX fuera en buena medida auspiciada y gestionada sobre una base voluntaria. No obstante, parece claro que los científicos/soldados o científicos/políticos resultaron multifuncionales, usando el conocimiento, en la frase de Steven Shapin, no sólo para la “predicción y control de los fenómenos “sino simultáneamente “para legitimar estructuras en la sociedad más amplia”. Al servir a los gobiernos europeos en ambos niveles, ellos ayudaron a hacer de la ciencia un instrumento del Estado.

En el siglo XIX, tanto en Europa como en las periferias prevaleció la ética utilitaria, combinada con el elemento de patriotismo que se asociaba en un caso al fervor expansionista y en el otro a la pasión independentista. A medida que la ciencia y el patriotismo suplantaron la creencia cristiana tradicional en el credo de las naciones, esta simbiosis se convirtió en una teología singularmente apropiada a la era que fue testigo del surgimiento del capitalismo moderno y del estado-nación como su expresión política. El internacionalismo inherente a la ciencia como valor epistemológico y axiológico se combinó con el prestigio nacional que fueron adquiriendo la ciencia francesa, inglesa y alemana. En el supuesto que el científico era un integrante de la “república de la ciencia”, un ciudadano del mundo, sus contribuciones al patrimonio internacional y universal de la ciencia se suponían independientes de fronteras nacionales. En la exportación del pasteurianismo a los trópicos e inclusive a todo el mundo, sus miembros defendían la existencia de una “ciencia pasteuriana”, i.e. una clase paradojal de ciencia, universal en su alcance y objetivos pero no obstante implícitamente francesa, que incluía el compromiso con la teoría de los gérmenes de la enfermedad, la implementación de nuevas técnicas bacteriológicas, y una visión fresca de la epidemiología de campo (Moulin, 1992). El siglo XIX fue conocido como el siglo de la ciencia “básica”, “pura”, “fundamental”, separada de los resultados “impuros” de la tecnología e inclusive de la ciencia aplicada. Si bien las periferias y colonias contribuyeron sustancialmente al avance de la ciencia “básica”, ya desde una etapa temprana de configuración del orden científico internacional se las vinculó a actividades de aplicación de resultados.

La movilidad cientifica en el mundo contemporáneo y el dilema de la ciencia latinoamericana

A fines del siglo XX, en otro golpe de timón de la historia, las oportunidades de mercado parecen haber tomado el lugar del patriotismo como el credo más reciente en un mundo dominado por un control de nuevo cuño, el de las corporaciones multinacionales. La ciencia contemporánea ha cambiado su identidad respecto de la ciencia de fines del siglo XIX. En ella hoy se enfatiza cada vez más lo técnico y en la medida que las técnicas proliferan, llevan a la fragmentación del conocimiento en campos pequeños que son intensivamente cultivados. Con intensidad variable dependiendo de la disciplina y especialidad de que se trate, se observa un incremento de las redes formales e informales para la comunicación con colegas distantes, para acceder a bases de datos remotas y para distribuir los resultados de la investigación, asociadas a una creciente movilidad académica.

En el proceso más reciente de globalización de los mercados, no sólo se vuelven más intensos los flujos de capital, hasta el punto que se argumenta sobre la habilidad del estado-nación de proteger los intereses y el bienestar de sus ciudadanos, sino que también los flujos de capital humano comienzan a asumir una volatilidad similar a la de su contraparte financiera. En el proceso de fusionar los mercados nacionales en una versión planetaria del mercado, el capital humano seguiría al capital financiero a aquellas regiones donde está más concentrado. De esta forma, la movilidad del capital humano se ubicaría en el corazón de la globalización.

A medida que las implicaciones de este proceso de globalización comienzan a cambiar la manera como percibimos a nuestras propias sociedades y su lugar en este nuevo orden, también nos obligan a revisar la imagen producida por la historia y la sociología de la ciencia acerca del proceso de constitución de comunidades científicas nacionales en América Latina y de la percepción de la "movilidad científica" y la "fuga de talentos" en esas comunidades. La visión convencional consiste en una explicación o narrativa del crecimiento de comunidades científicas nutridas a lo largo de la historia con nativos y flujos de migrantes científicos provenientes de otras regiones. El resultado se entendió usualmente como una ecuación demográfica verificable a través de la institutionalización de las disciplinas científicas en la región. El supuesto básico ha sido que de los flujos de personas e ideas resultaron culturas nacionales de ciencia o al menos tradiciones científicas locales.

En diversos momentos durante este siglo crecieron las posiciones antiimperialistas y nacionalistas, que acompañando el desarrollo de las clases medias y trabajadoras urbanas, sirvieron como fuerzas impulsoras para los movimientos que buscaban una redefinición más autónoma de la identidad nacional en sus diversas manifestaciones. La cuestión nacional y la cuestión social se enredaron en una compleja ecuación con que la historia desafió a los políticos e intelectuales en los más variados contextos, desde las páginas literarias, pasando por la tribuna política hasta, de manera menos conspicua, los recintos del laboratorio científico (Vessuri, 1991 ; 1990). A finales del siglo XX, sin embargo, a pesar de la multiplicación de nacionalismos, identidades étnicas y regionalismos en las antípodas de las afirmaciones universalistas con las que típicamente la ciencia ha estado asociada, resulta claro que dichos movimientos no lograron cambiar el ordenamiento económico-político mundial y la estructura jerárquica de la organización científica internacional.

Hasta la década de 1960 la cooperación internacional educacional y científica en la región latinoamericana se caracterizó por un alto grado de congruencia entre las políticas de los países donantes industrializados y las "necesidades" articuladas por los receptores de los países en desarrollo. Estudios influyentes de la época (por ej. Schutz, 1963), mostraban los efectos de aumento de la productividad que tenían las inversiones en educación revelando que la magni-

tud de los efectos crecía con el nivel educativo. Con más de una semejanza con los procesos de afiliación de las instituciones coloniales con las metropolitanas en el siglo XIX, una cantidad de universidades y agencias de los países industrializados se involucraron en la construcción de instituciones y programas en la región.

Pero los resultados con frecuencia no estuvieron a la altura de la promesa contenida en la retórica tecnocrática internacional y muchos países sufrieron el desencanto de ver que la educación y la ciencia no resultaban la panacea que esperaban y se convertían no pocas veces en una parte significativa del problema. Sus egresados eran "funcionales", por sus expectativas y necesidades, para contextos sociales desarrollados y no para aquéllos en los que normalmente les correspondía desempeñarse. La falta de endogeneización se expresó así, entre otras, en la tan mentada crisis de la "pertinencia social" de la institución universitaria latinoamericana. La crisis económica que afectó a la mayoría de los países latinoamericanos en la década de 1980 aumentó aún más las dificultades de la investigación científica. Pese a que en América Latina ya hay loci institucionales para la ciencia "con condiciones de formar investigadores tan buenos o tan malos como los del primer mundo, éstos funcionan en contextos culturales que siguen sin estar preparados para albergar aparatos científico-técnico-productivos moderno" (Cereijido, 1994).

Se critica hoy como ingenua la búsqueda de autonomía relativa que caracterizó a los planteamientos teóricos latinoamericanos de los años de 1960 en búsqueda de vías de desarrollo alternativos a los dominantes, y se abraza el mito de la globalización económica. No obstante, en la práctica todavía la investigación científica sigue siendo en buena medida una actividad que se financia dentro de marcos nacionales y se realiza en el seno de instituciones localizadas en contextos particulares, más aún, se identifica con laboratorios específicos, como lo ha mostrado la literatura construccionista sobre microsociología de la ciencia (Latour & Woolgar, 1979 ; Knorr Cetina, 1981).

Es en esos contextos que hoy vuelve a plantearse el tema de la "fuga de talentos" en la región, en la convicción compartida por diversos comentaristas sobre el estado de la actividad científica latinoamericana, que cantidades relativamente significativas de científicos e ingenieros están abandonando algunos países de la región. Esta convicción refleja una ansiedad particularmente significativa por darse después de cincuenta años de esfuerzos de modernización y desarrollo de parte del Estado y la sociedad civil, en los cuales la ciencia y la tecnología aparecieron con frecuencia indicados como componentes críticos de dichos esfuerzos. De hecho, la evidencia cuantitativa sistemática sobre el tema es variable y la profundidad de la reflexión sobre su significación e implicaciones también. Resulta superficialmente atractivo ver la emigración como expresión simbólica de un veredicto sobre las políticas gubernamentales. En la década de 1980 Gran Bretaña experimentó un aumento notable de la emigración de sus científicos al exterior, especialmente Estados Unidos, y eso se tomó como una respuesta masiva a la política de la administración Thatcher (SEPSU, 1987).

Un símbolo políticamente efectivo debe ser emotivo y simple. La emigración es por cierto emotiva ; pero no lleva mucho tiempo darse cuenta que no es un fenómeno simple (Collins, 1988). A veces puede tratarse simplemente de la ausencia de políticas del Estado lo que hace que el científico se sienta huérfano de apoyo o de una demanda social por su labor. Otras veces se trata de la percepción del cercenamiento de la independencia de investigación por excesos de presiones políticas, económicas o ideológicas. Hay un componente individual importante respecto a las decisiones que influyen la forma de hacer una carrera científica. Pero cualesquiera sean las causas o motivaciones, decididamente hay diferencias entre los movimientos de corto plazo y los de más largo plazo, más apropiadamente llamados migraciones.

Los movimientos de corto plazo entre centros y naciones por parte de los investigadores han pasado a ser centrales a la actividad normal de la investigación y existen muchos esquemas para promoverlos. A este tipo de movimientos se refieren los programas de movilidad académica como los de la Unión Europea y, en nuestra región, los del Grupo de Montevideo y los

de diversas redes académicas disciplinarias. Ese movimiento es impulsado por las comunidades científicas y los poderes públicos. Se argumenta que la movilidad abierta, sin barreras, es lo que necesita la ciencia en el presente, de allí las políticas públicas de los países desarrollados que estimulan dicha movilidad. En esa perspectiva, el peligro estaría dado por la no circulación, la construcción de barreras para evitar la libre circulación. El riesgo sería similar al de las regulaciones de protección de mercado que impidieron muchas veces la participación de las industrias locales en el dinamismo de la innovación tecnológica internacional.

Se ha observado que estos viajes o traslados de corto plazo (convencionalmente por corto plazo se entiende una estadía en el exterior de hasta tres años) sirven para que los científicos disminuyan las restricciones que experimentan en su actividad de investigación. Las carreras de investigación están constreñidas por falta de fondos (especialmente fondos no amarrados), falta de acceso a equipos, otras demandas sobre el tiempo del científico, desafíos de grupos competidores, la necesidad de trabajar de acuerdo con una manera aprobada o generalmente aceptada e insuficiente credibilidad para conseguir que sus ideas o propuestas sean aceptadas (Carlson & Martin-Rovet, 1995). Sea que trabaje en temas marginales o no, un científico puede beneficiarse de las diferencias en ambientes de trabajo porque las debilidades de un sistema pueden ser menos restrictivas para alguien de afuera. En todo caso, lo que le conviene a un científico es cualquier cosa que fortalezca su credibilidad y autoridad. La movilidad es útil para el logro de este objetivo. Es una manera de favorecer, aunque sea temporal o parcialmente, la colaboración y la comunalidad, al mismo tiempo que tal vez permita que el científico adquiera un filón competitivo para cuando regrese a su sitio de trabajo habitual.

En esta conceptualización del problema, es sólo la emigración de largo plazo la que debiera dar lugar a ansiedades acerca de una “fuga de talentos”, y en tal caso sólo bajo ciertas condiciones. Sin embargo, cuando se observa el proceso puntualmente, no es sencillo distinguir la migración de largo plazo de la de corto plazo. Es necesario hacer comparaciones en el tiempo, tomando en cuenta la duración de los lapsos de estadía en el exterior. La ansiedad aumenta en países como los latinoamericanos por el reconocimiento de las debilidades de los contextos institucionales y sociales que debieran reabsorber a quienes salen al exterior a desempeñar sus funciones científicas específicas, ya sea en la etapa de formación de postgrado, o en estadías supuestamente menores de intercambio científico en una etapa intermedia de su carrera. En más de un sentido dicha ansiedad pareciera vincularse al reconocimiento que la naturaleza de las profesiones científicas y la formación de investigadores los predispone a la emigración, pues su formación y experticia resulta en buena medida irrelevante a los mercados de trabajo locales y en cambio es directamente funcional a los mercados de trabajo de los centros desarrollados.

Por lo tanto, para la caracterización del fenómeno no basta con considerar las cantidades de emigrantes, ni tampoco con analizar cuánto tiempo permanecen en sus nuevos países y si eventualmente regresan. También debe considerarse, el contenido y calidad de su formación, la edad y experiencia de los emigrantes, sus características familiares, los motivos por los cuales se trasladan, las características del sistema nacional de investigación científica, el patrón de industrialización, las políticas de fomento del Estado, las relaciones internacionales, etc. Deben tomarse en cuenta tendencias cambiantes en el tiempo a medida que cambian las condiciones del pais de origen y de los países de destino. Y junto con los datos sobre los emigrantes, deben recogerse datos sobre inmigrantes que recibe un mismo pais. El grueso de la literatura sobre migraciones incluyendo las de científicos trata el asunto bajo el supuesto que los migrantes se mueven por necesidad forzosa, lo cual no necesariamente es el caso, en particular en el caso de los científicos si aceptamos que la dinámica de la movilidad está en la base de la carrera. Los científicos pueden migrar para fortalecer sus credenciales “internacionales” o para dar salida a ideas marginales y fuerzas centrífugas que no encuentran acogida en su medio local. Pero aún con todos los datos, nos quedaríamos con problemas de interpretación.

De hecho, se observa la existencia de una jerarquía cambiante de lugares en el mundo que ofrecen combinaciones de factores específicos, algunos de los cuales favorecen la recepción y otros la expulsión de científicos. En el presente no hay un centro sino una variedad de centros de distinto peso e influencia con vectores que apuntan en distintas direcciones. Aún así, hay centros de centros y Estados Unidos sigue conteniendo una gran cantidad de centros institucionales y disciplinarios atractivos por mantener elevados estándares, concentrar recursos y ser capaces de dar formación científica, acceso a equipos y credenciales útiles a los científicos de la periferia. América Latina parece condenada a seguir produciendo científicos para llenar sus aspiraciones y necesidades como sociedad y para poder tener oportunidad de que sus ciudadanos desarrollen su potencial cultural, intelectual y científico. Como región y dentro de ella los países que la componen se arriesgan a perder una parte apreciable de esos científicos en el camino hasta lograr crear condiciones más favorables para la empresa científica, pero la alternativa sería simplemente no ser, renunciando al desarrollo de las capacidades. Justamente aquí es donde el carácter demasiado intrusivo del modelo dominante "internacional" puede hacer perder de vista las ideas sobre qué clase de ciencia o qué medios para qué fines serían los más útiles para los problemas de esas regiones. En la perspectiva de una ciencia "internacional" sin fronteras, la periferia deja de tener sentido al ser incluida en el modelo monolítico centralizado de la competición global. En cambio, en la perspectiva de la historia de la ciencia latinoamericana se observa que ésta no funciona exactamente como las corporaciones multinacionales de la IyD sino que hay toda una gama de contribuciones localizadas, mayores y menores, al mosaico de la ciencia y que la periferia puede ser más innovadora que los centros pues éstos tienen inversiones muy fuertes que conservar. De ese modo, a pesar de que la ciencia como fundamento del desarrollo industrial se vuelve crecientemente homogénea y que hay un encaje fácil entre el modelo de la ciencia central y las políticas económicas dominantes, todavía hay un margen de maniobra para orientar los resultados de la ciencia periférica en direcciones originales. La movilidad de los científicos, también en estos casos, puede servir para entender mejor, para volverse más concientes de lo que no se sabe y poner en perspectiva más adecuada los proyectos válidos y originales de la periferia conectando los esfuerzos locales.

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Brain Drain and New Mechanisms of Funding in Russian Science

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Russian science is currently in crisis, internal and external « brain drain » process is one of its manifestations. Since the disintegration of the USSR three waves of “brain-drain” may be distinguished. Before observing this process in historical perspective it is important to give some definitions.

The term “brain drain” was defined in 1962 by the British Royal Society in a report on the emigration of scientists and technicians from the country towards the United States [1]. In 1972 at the Third Meeting of the United Nations Conference on Commerce and Development, it was defined as a problem of “reverse transfer of technology”.

In Russia the structure of such phenomenon as a brain drain is very complicated and besides obvious includes some “hidden” forms. The main forms of outflow of intellectual resources from Russian science are the following :

- emigration which means permanent residence abroad ;
- contract-based employment abroad which may become the first stage to actual emigration ;
- leaving science for another type of activity ;
- work for foreign firms and organizations on the Russian territory. This is a specific form of brain drain for countries with undeveloped laws in the science and technology spheres (for example, with poor regulations of intellectual property rights) and cheap science and engineering workforce ;
- so called “informational emigration”. This is also a specific form of intellectual emigration for Russia. Foreign publications are inaccessible to the majority of Russian scientists, and in this way publications of Russian researchers abroad is in fact lost information for their colleagues at home.

All official assessments of brain drain process in Russia are not reliable because of scarce and inadequate statistical basis. Then, there exist some forms of poor formalised processes which actually are types of “brain drain”. For example - part time job outside scientific sector. According to some expert data, about 90 % of personnel in R & D sector in Russia have part-time job in other branches of the economy (*Nezavisimaya gazeta*, 1994). As a result the main trends of the brain drain process from Russian science may be traced only on the basis of *different statistical samples and sociological surveys*. This information helped to reveal the historical “waves” of brain drain. The suggested lower chronology concerns mostly the actual and contract emigration. Internal emigration, i.e. leaving science for other types of activity, is hardly separated on “periods”. This process is permanently developing without any notable splashes. Other forms of brain drain named above are not studied enough yet.

The first wave of “recent” emigration may be dated between the end of 80s and the beginning of 90s. That time was in some sense transitional, because it began before the disintegration of the USSR. In the years prior to the Soviet Union´s eventual dissolution, Soviet leaders had little reason to be concerned about a possible emigration of scientific personnel because of tight controls over travel abroad. That is why the first wave of “scientific” emigration was not very

large. For example, during 10 years -from 1982 till 1992- the number of those who have emigrated to USA was 4962 persons, from which 15 % (738) were researchers [2].

At that period *scientific elite* was the main contingent among researchers who left the country. These scientists were well-known in the international scientific community. Surveys have shown that scientific elite found its place abroad : about 70 % of those who left the country at this period of time found job at universities and R & D organizations.

The other significant flow was by the channels of ethnic emigration. But those who left for abroad because of ethnical reasons usually did not continue to work in the science sector in the new country of residence.

The second wave of emigration was in 1992-1993. That was the period of the most intensive emigration abroad and, correspondingly, the time of the geatest attention of mass media to this problem. The second wave was partly connected with new legislation. In January 1, 1993 the Law on the procedures of Exit from the USSR and Entry to the USSR for Citizens of the USSR was enforced. The measure was designed to allow freer travel abroad for Soviet Union´s citizens and was passed by Supreme Court Soviet on May 30, 1991.

During 1992-1993 the first official data on the scientific migration were collected and aggregated. Estimations on the basis of the official statistical data showed that in 1992 about 400 scientists emigrated abroad for permanent residence, in 1993 - 426 scientists. It means that in 1992-1993 the rate of emigration of R & D personnel was more than for all 10 previous years.

According to expert data *contract emigration* was higher in 4 times. In general, the share of external brain drain was at the level of 5 % from the total outflow of specialists from the science sector (Kitova, G. Kuznetsova, T. Kuznetsov, B., 1995). Furthermore it was estimated that only 20-40 percent from the total number of those who left for abroad obtained positions in the science sector.

At the same time the decreasing percentage does not mean real decrease of those who stayed in science abroad in comparison with the previous years. The scale of the second wave was larger than of the first one, so the values counted in numbers were close to each other and the number of those who continued to work in science sector abroad stayed stable.

The “generalized picture” of brain drain in 1992-1993 looks as follows. Typical emigrant - a man at the age of 31-45 years old, having Ph.D. and engaged in theoretical research. In most cases the researcher had a large number of publications. According to different surveys physicists and mathematicians were leaders in disciplinary structure of emigrants, taking together more than 50 % of total number of emigrants, followed by biologists (about 30 %) and chemists. The biggest share of emigrants was from Moscow, S.-Petersburg and Novosibirsk - the main Russian scientific centers. Country contributions was not stable from year to year (see Table 1).

Table 1. The distribution of emigrants from science sector by new country of residence

Country	**The share of emigrants, % to the total number of the emigrants from science sector :**	
	1992	**1993**
Germany	60.48	66.9
Israel	25.44	21.0
USA	10.43	8.6
Greece	0.94	1.6
Canada	0.22	0.4
Australia	1.09	0.3
Other countries	1.40	1.2
TOTAL	*100*	*100*

Sources: Nikipelova, E..Gokhberg, I. Mindeli, I. (1994) ; O. Ikonnikov (1993),

Different sample surveys revealed that *the proportion between the number of emigrants on the permanent residence abroad and the number of those researchers who left science for another activity inside the country was 1 : 10* (S. Egerev. Poisk, 1996), i.e. on one scientist who left for abroad there were ten researchers leaving science for another sector of the economy inside the country.

At that period of time the dominating number of young researchers under age 30 who left science found themselves in private enterprises inside the country. At the same time the intensity of youth emigration began to grow : *in 1993 thirteen thousand of graduates left Russia for abroad* (S.-*Petersburg vedomosti*, 1994). The study of emigration moods among students (Radaev, V. 1995) showed that 10 % wanted to leave Russia, and about 60 % would like to work abroad on the basis of long-term contracts. From those 10 % who was ready to emigrate the predominant number did not want to work in science. The greatest number of potential emigrants were from Moscow and S.-Petersburg regions and belonged to "student elite". They had good computer education and knowledge of foreign languages.

The third wave of emigration started in 1994 and is continuing at the present time. The important sign of this period is the increase of those who were ready to leave the country with guarantee of any job, not always in the science sector. But some surveys revealed that he share of those who not only wanted but also could leave the country was only about 4 % (Mirskaya, E., 1994). These are mostly science leaders and young researchers from the laboratories and institutes with international connections. The typical representatives of potential emigrants continued to be physicists, mathematicians, specialists in computer sciences, genetics, biotechnologists, virologists. All these specialists who provide the social and technological development of the country.

The main feature of this wave became the growing share of graduates and young researchers among those who leave science. *Today the "main body" of emigration consists of undergraduate students and graduate students, and young researchers at he age up to 35 years old.*

In 1994 the share of *potential emigrants among students* was already about 40 % (Morozov, A. 1994). Then, potential young researchers not only have high emigration moods, but they also began to see their future out of science sector. From this point of view specially dramatical situation turned out in those discipline which were very prominent in Russia : for example, in theoretical physics up to 80 % of students are not going to work as physicists and some of them, even in science at all.

A characteristic sign of the contemporary situation *is the increasing outflow of students and graduate students* who are potential R & D workforce for Russian science. The most popular for continuation of education are different American universities and colleges (see Table 2). While the share of the students who receive their education in the U. S. is slightly decreasing, the total number of former Soviet Union students in this country has increased in 19 times during the last 5 years. The prevailing number of young people wishing to enter foreign university can not pay for their education. The level of competition for those who need financial support is the highest. It means that only the best become graduate students in foreign universities. That is the main difference between this contingent of "brain drained" and other scientist-emigrants. For the last group the "real quality" of scientific personnel leaving the country is uncertained. After studies abroad, specially graduate, a very small share of graduates return home.

Although the number of graduate students from Russia is considerably large and is permanently increasing, the total number of those who earned Ph.D. is still very insignificant. According to the U.S. National Research Council who provides annual surveys of earned doctorates, the number of doctorate recipients from U.S. universities who reported that they were citizens of Russia was zero from 1979 to 1992. In 1983 there were research doctorate awards to 5 Russian citizens, in 1994 18, and 45 in 1995. It is great increase, but in comparison with

the number of graduate students - not so much. In 1995 it was only 0.3 % of all doctorate awards. One of the explanations is that thesis is prepared during several years, so those who received Ph.D. in 1995 entered graduate school in 1990 or around this year. It was a period with more closed borders than after the disintegration of the USSR. Today the number of graduate students in the U.S. universities is increasing dramatically. In some universities there appeared entire Russian communities. The outburst of the number of Russians with Ph.D. should be expected in 2-3 years. Those who, today, go to study abroad may be divided into two main groups : those who immediately are looking for possibility to stay abroad forever ; those who try to keep in touch with their colleagues in Russia - mostly through joint projects supported by different science foundations, and through contracts.

Table 2. The distribution of students from the former USSR among leading Western countries

Host country	**Number of students/percent**				
	1990/91	**1991/92**	**1992/93**	**1993/94**	**1994/95**
USA	167/39.5 %	387/55.6 %	1081/76.4 %	2094/68.9 %	3159/65.4 %
France	83/19.7 %	144/20.7 %	136/9.6 %	388/12.8 %	613/12.7 %
Germany	108/25.6 %	92/13.2 %	92/6.5 %	417/13.7 %	746/15.4 %
Great Britain	61/14.3 %	63/9.1 %	71/5.0 %	75/2.5 %	120/2.5 %
Canada	4/0.9 %	10/1.4 %	35/2.5 %	667/2.1 %	193/4.0 %
TOTAL for 5 leading countries	423/100 %	696/100 %	1415/100 %	3041/100 %	4831/100 %

Data were counted on the basis of the sources :
1. UNESCO Statistical Yearbook 1990, table 3.15, pp III381-439.
2. UNESCO Statistical Yearbook 1991, table 3.15, pp III398-423
3. UNESCO Statistical Yearbook 1992, table 3.16, pp III390-415.
4. UNESCO Statistical Yearbook 1993, table 3.14, pp III363
5. UNESCO Statistical Yearbook 1994, table 3.16, pp III433.

The USA still give the largest possibilities for employment in the science and technology sphere. Data for the USA (see Table 3) shows that the situation with inflow of Russian scientists was not very dramatical. First, because the average « quality of Russian researcher » is rather good ; second, because Russians do not take the largest share of R & D immigrants. According to Immigration and Naturalization Service data [3] China and India take together 37.9 percent of all S & E immigration (20.44 % and 17.5 % respectively).

Table 3. The distribution of scientists and engineers from the former USSR admitted to the U.S. on permanent visas, by occupation and labor certification

Occupation	1991	1992	1993
Engineers	494	468	725
Natural Scientists	73	93	211
Math Scientists and computer specialists	64	67	113
Social Scientists	37	36	51
Total S&ES	**668**	**664**	**112**
From total :			
Certified	5	15	96
Non Certified	663	649	1031

Note : Data present only those S & Es who had USSR as a country of last residence.
Sources : 1. Immigrant Scientists, Engineers and Technicians : 1991-1992. Detailed Statistical Tables. NSF 95-310, Tables b-5, B-19, B-20. 2. Immigrant Scientists, Engineers and Technicians : 1993. Detailed Statistical Tables. Unpublished NSF data, Tables B-4, B-11.

Data from Table 3 show that emigration of former Soviet Union researchers remains spontaneous, because the number of certified immigrants is still very low, the highest share was 8.5 % (for 1993). At he same time the rate of increase of this category is impressive -from 0.7 % in 1990 till 8.5 % in 1993- about 12 times increase. Certified workers are those who already had agreement about future place of work before they left the country. It means that these category of researchers definitely stayed in the science sector abroad.

As a result of these three waves of emigration today from 100 Russian researchers who have the highest indicators of science citation index more than 50 researchers live and work permanently abroad [4].

At he present time the number of scientists in total number of employed in the economy of the country became twice as less in comparison with 1991.

Aggregating the data of different sociological surveys one may distinguish the main *motivations for science emigration* during the past 5 years. These are the following :

1) economic and political situation in the country ;
2) low level of prestige in the society, uncertain perspectives ;
3) the absence of necessary conditions for research : low level of salary, unadequate equipments and instruments, poor informational support of research ;
4) undeveloped rights on intellectual products ;
5) for researchers from regions - difficulties in access to big scientific centers with better conditions for research ;
6) for young researchers, impossibility to receive dwelling, specially in special “science cities”.

For those who leave science for other types of activity or for abroad the predominant factor is the low level of personal income. Those who leave the country on the basis of long-term contracts, a very significant factor is the possibility for professional realization which includes work in good equipment, access to foreign informational resources, professional contacts with colleagues.

From the other hand there was a number of *obstacles,* both objective and subjective, such as :

1) “immigration capacity”, i.e. the possibility of the western science and technology market to accept foreign specialists ;
2) the difference in qualification standards, habitual conditions of research work and in organization of scientific process ;
3) uncertainty in future job placement.

Unfortunately all motivations for emigration keep being true at the present time.

If we analyze the process of brain drain in correlation with the financial situation in Russian science the picture will be much darker. To evaluate the real state of science in Russia means to look at the evolution of research and development (R & D) financing. Federal funding is still the dominant domestic source of support for Russian science. Its volume is permanently decreasing. For normal science development the presence of some “critical mass” of scientific personnel is necessary. Usually its actual value correlates with the share of the expenditures on science in Gross National Product (GNP). According to expert data, the destruction of national scientific potential may happen if the share of expenditures on science in GNP during 5-7 years will be lower than 1 %. In Russia during the past 4 years this share was under 1 % (see table 4).

Table 4. The dynamics of the expenditures on science in GNP and emigration of the specialists from the economic branch “Science and education”

	1992	**1993**	**1994**	**1995**
The share of expenditures on science in GNP, %*	0.69	0.52	0.44	0.29
Number of emigrants	4572	4088	5171	5500**

* In 1991 the share of expenditures on science in GNP was 1.03%.
** Preliminary data.

Table 5. International R&D expenditures as a percent of GNP

Country	**1992**	**1993**	**1994**	**1995**
United States	2.7	2.6	2.5	2.4
Japan	2.8	2.7	na	na
Germany	2.5	2.5	2.5	na
France	2,4	2.4	na	na
United Kingdom	2.2	2.2	na	na
Italy	1.3	1.3	1.2	na
Canada	1.5	1.5	1.5	na

na = non available.
Source : Science % Engineers Indicators, 1996, appendix Table 4-33, p. 154

In 1996 the dramatism increased. Science was not financed from the federal budget at the beginning of the year and during three summer months. It was a new crisis of financing. Until August 1996, the science sphere received as budget only 50.8 % of the expected and planned level. As a result today only 17 % of researchers in Russia have salary which exceeds the official level of poverty ; the level of income in “science” taken as a branch of economic activities occupies the 10-th place among 11 branches as counted in statistics [5].

The science budget planned for 1997 is even lower than for 1996 : 2.65 % of the expenditures from Federal budget (in 1996 -2.7 %). It shows that science in the list of federal priorities still has low rating. As a result the problem of brain drain may become extremely actual again, and in 1996 there even appeared a new definition, “organized emigration of scientists”, which means that the whole laboratories from R & D institutes are ready to leave the country.

Russian government structures which are responsible for S & T in the country try to resist the outflow of scientists. In 1994 there was created an Interagency Program for Regulating the Migration of Science and Technology Specialists. The program contained urgent measures to prevent brain drain and long-term issues aimed to coordinate and monitor this process. Urgent measures were for period till the middle of 1995. They included the development of legislative basis which help to prevent the outflow of researchers, and some economic measures such as implementation of a contract system in the science sphere. These two main directions have not been put into practice till today. Long term initiatives included the development of the alternative to federal budget sources of support for science, the creation of science foundations, the stimulation of international contacts. Some long-term measures are under implementation at the present time.

Today a number of initiatives aimed to support science and to prevent the brain drain process exist. These are : grant system of support, selective federal support of the best scientific collectives and schools, and institutions. Additional funding at the level of certain organization is provided for those R & D institutions who received the status of *Federal Research Center* (FRC). In 1995 there was started a program of support for leading scientific schools and the best 100 young researchers (up to 40 years old) with doctorate degrees. Unfortunately these two initiatives are conservated because of the lack of federal money. Some other initiatives were more successful.

Federal Research Centers appeared in 1993. The idea was to preserve the leading directions of research through special support from federal budget. Today there are 61 such Centers, about 1.5 % of total number of scientific organizations in Russia. In 1995 they received about 6 % of the entire federal allocations on science.

Researchers and research teams may receive support applying for grants from the federal foundations. In 1993, the first Federal Russian foundation - Russian Foundation for Basic Research (RFBR) - began its activity, in 1994 Russian Science Foundation for Humanities (RSFH) started its work. These foundations are assigned 4 % and 1 % respectively of all federal budget allocations for science. Therefore the Russian foundations represent one more form of distribution of federal support and at the same time they constitute new institutional and motivational mechanisms and in this way may have an influence on the mobility of the scientific community.

During the same period of time there appeared a new and very influential source of financing for Russian science - *foreign grant-awarding foundations*. Since opening their offices in Russia, a number of these foundations have developed special programs to support natural and social sciences, and humanities. In 1994-1995 these foundations' share in supporting basic research was equal to the share budgeted by the federal government for this purpose. This is the reason why the foundations' selective influence on the social behavior of the scientists may be considerable.

Foreign foundations and emigration of Russian researchers for abroad

The evaluation of different foreign foundations' activity from the point of view of their influence on the brain drain process showed that there is a strong connection between the level of mobility and different mechanisms of grant awarding procedures. The level of impact of the foundations' programs is tied to such parameters as :

1) type of grant award (scholarship abroad or implementation of research project in Russia) ;
2) for scholarships abroad, type of research (basic or applied) and duration of grant ;
3) grant size, conditions and regulations of award.

Empirical data demonstrate that *scholarships and fellowships abroad* are still in many cases the first stage to actual emigration. In opposite, *grant awards for conducting research in Russia* keep researchers at their home institutions. A good example here is International Science and Technology Center (ISTC). It is one of the most successful initiatives aimed to help the conversion of weapons scientists and engineers. ISTC projects are funded by the United States, the European Union and Japan, as well as Finland and Sweden, which joined the ISTC before acceding to the European Union. Since March 1994 ISTC made awards on $82 million for civilian projects to promote a reorientation of the defense research. Today ISTC provides its support to 11500 researchers that is about 17 % of all specialists who have access to special secrets.

Its activity helped to prevent emigration what is especially important for defense-related scientists. All researchers continue to work under projects, and they have not to look for another sources of support : first, grant size is large, and second, according to ISTC regulations no less than 50 % of a grant must go to the salary. That is quite opposite to the situation in Russian science foundations - RFBR and RSFH. The salary must not be more than 50 % of a grant and grant award itself is not very large. Then, the duration of ISTC projects is three years. It permits to do qualified research without seeking for additional financing every year. The similar rules prevailed at the International Science Foundation (more popularly known as Soros foundation by the name of its sponsor). The researchers were free in determining how to spend their grant award. And the duration of the grant was of 2 years. Three years grant duration is also a practice at USA National Science Foundation (NSF) International Projects Division. They also permit to apply for grant extension. *Grant size and duration are very actual for Russian researchers because in current economic situation grant in general serves as a replacement of actual salary*.

Some foundations have special - direct and indirect - regulations aimed to prevent brain drain from Russian science. An example of *indirect regulation* is given by NSF. International grants for Russian scholars are based on the model "receiving side-pays costs", which means that a Russian scholar receives only living expenses during his visit abroad. It stimulates most of researchers to spend short period of time abroad, because in that case it is not a way to earn on leaving. The practice shows that in average Russian researchers spend no more than one year abroad during a three-year grant period.

Direct regulations are constituted at the Civilian R & D Foundation (CRDF) - a new USA foundation established to support cooperative grants program in civilian environment in Russia. According to its rules, a Russian researcher is permitted to stay no more than three months in the U.S. during a two-years grant period.

In fact, the same direct regulations exist in Russian science foundations -Russian Foundation for Basic Research and in the Russian Science Foundation for Humanities. According to these Foundations rules, if the principal investigator works abroad more than 3 months, the funding of the project can be terminated.

Scholarships and fellowships as well as awards to conduct joint projects abroad form another type of support. In that case, the influence on research mobility factors depend on the type of supporting activity (basic or applied research) and the duration of the grant size. It may be illustrated by the results of the activity of two U.S. programs - CAST (Cooperation in Applied S & T) and COBASE (Cooperation in Basic Science & Engineering). A survey among American recipients of these programs revealed that there was some number of Russian researchers who emigrated abroad after completion of these programs grants. The rate of emigrated researcher who participated in CAST program was much higher than from COBASE : 35 % against 14 % respectively. The duration of CAST program is one year, while COBASE - up to six months. During one year a researcher has more possibilities to find a new position. Then, the CAST program, providing support for applied research helps to find contacts in the U.S. industry. The same survey showed that 85 % of Russian researchers had developed contacts with U.S. firms. In a context of emigration problem it means that probably it became also their potential new place of work. Chances to receive position in the industrial sector are in average higher than in academic sector. The distinctive feature of CAST program was also the age of Russian participants : about 50 % of them were younger than 40 years old. And that is a bad sign for Russian science.

An interesting detail in the COBASE program was the specialization of emigrated researchers : 2/3 of them were chemists. And for half of them ethnical motivation predominated. That is not an accidental result. According to data from the Siberian Branch of RAS [6] there was an abnormal growth in the number of emigrated chemists especially those who worked in the technology applied spheres. The explanation of this fact may be found in the character of the chemical community and in the peculiarities of the jobs in this sphere. It means that the chemical scientific community, specially in the USA, was comparatively closed for newcomers, in comparison with physical or biological communities. They started to accept foreign researchers later than in another disciplines. Then, in chemistry there is a much bigger variety of simple applied tasks than in physics or biology, and a lot of works with dangerous materials (for example with radioactive materials). These positions are not very attractive for permanent residents of the country. In the situation when from one hand the foreign market is tough, and from the other, the conditions in Russia are not improving, Russian researchers began to accept jobs which demand low qualification or are dangerous for health.

A separate position occupy the foundations and programs awarding grants for studying abroad. For example, Edmund S. Muskey fellowship program provide scholarships for Master´s-level study in the United States universities. In Russia this program is provided through “funder-driven” organizations -IREX, ACTR, “Open Society” Institute. The rate of returned back participants in this program is 95 % -97 %. The rest 3 % -5 % are staying in the U. S. to continue their education in Ph.D. programs. One of the measures which prevent from an effective brain drain in this program is the strict order to return after completion of the grant or to return the cost of education.

Long term joint projects implemented abroad are still considered as a hidden possibility to escape. They permit to work with foreign colleagues, and to be tightly involved in scientific life abroad. All these helps to find a new occupation. Unfortunately, that is still indication of a bad situation in Russian science. In current economic environment the best types of support from the foreign foundations are short-term fellowships abroad and support of research activity in

Russia. “Shuttle” visits are prefered in both directions. The popular concern that it is impossible in Russia to conduct research because of out-of-date equipment not always keeps true. CAST survey revealed, for example, that in several cases Russian researchers brought abroad with them the unique equipment for collaborative research in the U.S.

It is important to note that not only above mentioned types of support are preventive for brain drain. The foundations themselves, as forms of support, influence more positively (i.e. resist) than negatively the brain drain from Russian science. A sociological survey conducted among Russian scholars in 1995, showed that, in average, foreign foundations and programs provide a positive influence on the sustenance of the scientific sector in Russia. Conducted among researchers from different parts of Russia Federation (Emilianov, E, Iaroshevskii, M., Urevich, A., 1995), it revealed that the majority of them (55.5 %) do not see any connection between the grant from foreign foundation and the wish to emigrate (see Table 6). But at the same time only 10 % of all respondents think that grants increase the wish to emigrate. This survey showed that foundations do not influence much on *internal brain drain to another sectors of the economy.* More than a half of all respondents supposed that there is no relation between these two factors, but only 25 % thought that grant reduced the wish to leave science. In general the most common position was that grants do not prevent leaving science for those researchers who already strongly made this decision.

Another sample survey, provided at the end of 1995 among researchers from all sectors and regions of Russia, helped to reveal to what extent foundations and foreign support as a whole open new possibilities for professional growth at home country and, accordingly, diminish brain drain [7]. Foundation help to improve professional skills abroad only for 33 percent of researchers in natural sciences, for young researchers this percentage is a little higher -30 percent. The possibility to work abroad temporarily is open for 33 percent of researchers in natural sciences. This data shows that foreign support for science is sufficient only for one third of researchers, mostly from big science centers, Moscow and S.-Petersburg, who have scientific degrees and work in fields which have perspectives abroad. Young scientists are in a beneficial position, because a number of foundations develop special programs to support young researchers or to help them to obtain a degree. That is important from the point of view of modern tendencies in the brain drain process.

Foundations also helped to reveal *comparatively new tendency :* the reestablishing of network between Russian researchers and those who emigrated abroad. This tendency is tracked by a number of foundations which provide support for joint projects : NSF, CRDF, CAST, COBASE. For example, for CAST program in 1996 11 percent of all applications were sub-

Table 6. Grant from foreign foundations and brain drain process :
the assessments given by different categories of Russian researchers
(in percent to the total number of respondents in each category)

	Researchers who have grants	**Researchers who do not have grants**	**Average assessment for sample**
- reduce to emigrate	16.2	13.5	15.0
- do not influence	56.8	53.9	55.8
- increases the wish to emigrate	9.0	12.4	10.5
The influence of grants on the process of internal brain drain			
- do not influence	55.0	52.8	54.0
- increase the wish to leave science	4.5	3.4	4.0
- reduce the wish to leave science	27.0	23.6	25.5

mitted by emigrated Russian researchers. The growing number of green-card keepers and even those Russian researchers who are temporarily affiliated with foreign institutions and are eligible to apply as non-Russian researchers try to create joint projects with colleagues in Russia. For example, in 1996 in CAST program 11 percent of all applications were submitted by emigrated Russian researchers. For COBASE the share of grant awards to the former Russian researchers is comparatively stable : 13 % in 1993, 18 % in 1995, 14 % in 1996. The latest example is given by the CRDF competition : 7 % of awards are given to the collaboration projects between Russian researchers and former emigrants. The greatest number of such awards is in physics (50 %) followed by biology (25 %) and mathematics (17 %). And that is a good indication. At he same time that tendency just reflects the existing mentality in Russian scientific network all over the world. For example, according to a sociological survey done among immigrant Russian scientists in Israel (Toren, N. 1996), over one half (52.2 %) percent of them consider that the most influential and authoritative for them are Russian researchers followed by USA scholars (18 %), Western Europe (12 %) and Eastern Europe (3 %) scholars.

Now there is a process of development of strong communities of Russian researchers who live and work abroad. The analysis of INTERNET networks shoes that if in 1991 the list users of special “Russian pages” in INTERNET included in average up to 30 addresses, today there are more than 1200 addresses. People try to stay in touch, to inform each other about possible grants and joint programs with Russian researchers, to help newcomers with better orientations in their new environment.

Another situation is with those students and young researchers who leave abroad to obtain a Ph.D. degree. They usually do not have scientific bakground and research experience in Russian science and as a result they are more strongly incorporated in foreign scientific communities, following its traditions, mentality and culture. For them ther will be weaker motivation for collaboration with Russian researchers, and that is the source of future problems.

At he same time this tendency is restrained by the internal situation on Western markets of S & T workforce. Now it is more and more true for the largest one, the U.S., that in the S & T sphere, the possibilities for foreign researchers to find occupation are becoming worse.

New context of R&D sphere in USA and employment possibilities for immigrants researchers

Main changes are connected with financial situation in the USA R & D sector. According to forecast estimations, to 2002 the federal expenditures on R & D will be reduced on 25 % in comparison with 1996. At he same time during the last three years therehas been some reduction of R & D in the industry sector. Besides, the Senate is discussing a bill to reform immigration law. An issue is a complex tapestry of visa categories and requirements. Today if the prospective employee from abroad falls into an “Outstanding Professors and Researchers” category, the door is open immediately. For the researchers from former Soviet Union there was the special Soviet Science Emigration Act (1993) which gave preferential emigration status to those Russian scientists who would like to emigrate. Under this act 740 Russian researchers have emigrated to the U.S. The current initiative in Congress is to eliminate the fast-track route to the green card for “outstanding researchers”. Now it must be proved that a prospective employee cannot be replaced by an American one, and that the immigrant will be paid the “prevailing wage”, a requirement designed to ensure that American worker will not be displaced for foreigners willing to take lower pay.

In current conditions the new U.S. policy in connection with the cooperation issues towards Russian science is selective support of different regions and directions of research *on the territory of Russia* in combination with issues to reduce the number of those researchers who work in the USA. For that purpose some regulations concerning time presence abroad are introduced in a number of foundations.

The comparatively big share of support will continue to be provided to defense-related research so as to stimulate conversional research. The example is ISTC activity with permanently growing number of financing projects. CRDF program is also based on a half on “defense money” from Department of Defense´s “Nunn-Lugar” program to promote demilitarization in the former Soviet Union.

Concerning the possibility to emigrate now the U.S. policy get closer to West European model, according to which only *scientific elite* will be invited and accepted.

European Community policy towards “brain drain” from Russian science

In opposite to a not very evident U.S. policy, the European Community has taken a number of initiatives to promote the mobility of Russian researchers with a view to develop their scientific potential while at the same time preventing a brain drain. The mobility is a key word in European policy towards brain drain process. It is proved that working with people whose way of thinking is different (and that is the case for scientific culture in another country) is a stimulus for research. Thanks to mobility, scientists can diminish the distance and linguistic barriers between them and establish the best “selling points” for their most important work (Martin-Rovet, D. 1996). Mobility is thus a mean to progress in a career. That is an interesting phenomenon that American hardly put into practice. Their acceptance of foreign scientific labor remains passive.

There is a number of EC initiatives aimed to support science in Russia and to prevent outflow of researchers. These are INTAS, COPERNICUS, TEMPUS and TACIS programs. INTAS and COPERNICUS point projects just started in full in Russia (first call for proposals was at the beginnig of 1996). The demand of these programs is the presence of at least two partners from European Community. That is aimed to develop networks and communications among Russian and European scholars.

Another specificity of the European type of initiative is the twinning of laboratories. This is particularly common in France (Tanguy A. de and Wenden, C. de), which has been doing it for 6 years. For example, a dozen researchers from Landau Institute in Moscow specialising in math and physics work in Paris under twinning arrangements with the Ecole Normale Superieure. And that is also an example of the way how the scientific elite from Russia science is selected and accepted.

It must be also mentioned that European Community “suffers” from brain drain from Russian science much less that the United States. This problem is not so actual there. For example, the number of those from Russia who worked at CNRS (Centre National de la Recherche Scientifique) in 1993-1995 was respectively 110, 122 and 81 with average duration of stay 4.2 months, 4.1 months and 4.5 months. These “shuttle” visits may have also promoted mobility, but not brain drain.

At the same time there is some new tendency in emigration routes of Russian researchers. Having emigrated initially to the U.S. they begin to search for possiblity to find a job in scientific sector in Europe. The explanation of this phenomenon may be the following. Russian and European science have much more in common in terms of scientific approaches, culture and scientific behavior. So for Russian researchers it is easier to adapt in European environment.

The other more evident factor is that in Europe Russian researchers in average have more chances to receive a salary equal to the level of European researchers, without restrictions. Till present time it was not the case for Russian researchers in the USA, specially in industrial R & D sector.

Financial transitions at the institute level from brain drain prospective

Two statistical sample surveys complemented by interview with the administrative and scientific staff conducted by the author in 1995 among 26 R & D physical and chemical institutes located in Moscow, S.-Petersburg, Novosibirsk and Nizhny Novgorod, helped to understand some correlations between brain drain process and new financial and organizational elements in Russian science as well as to reveal some new tendencies of the brain drain.

The distribution of the researchers by the type of activity abroad reveals that a large majority of scientific personnel goes abroad for short-term training : in average 57 % of those who worked abroad in 1995 were there during period up to three months. 19 % visited foreign countries so as to conduct joint research projects, about 14 % left for post-graduate study, and 3 % - to obtain Ph.D. The geography of visits abroad depends on the purpose of visit. For short-term business-trips scientists prefer Western Europe (Germany, Italy, France, UK) while they chose USA for post-graduate study and to obtain Ph.D. Joint research projects are actively conducted in Germany, France, USA and UK [8].

The most interesting were qualitative results of the survey. It helped to understand some latest tendencies in the brain drain process.

1. Among researchers who leave for abroad on the basis of contracts the number and share of those who are involved in experimental research is permanently increasing. In 1995 the share of experimenters varied from 65 % to 100 % of those who left for abroad on the basis of long-term contracts. Leaving abroad experimental researchers are in the most productive age - around 35-40 years old [9]. The loss of these categories of personnel leads to the break in the training of the next generation of experimental researchers. In three-four years it may result in irreversible fall of qualification in methodes and technics of experimental work. That is first. Second, if theoretical-researchers having returned back may enrich science at home, experimental researchers cannot apply their new knowledge in Russia, because they return to out-of-date equipments. According to the opinion of the scientific administration from the Institute of Solid Physics RAS, today modern experiments can be provided only abroad.

2. Another new tendency : those who left abroad try not only to maintain connections with their home institution [10], but also help to get in touch with foreign colleagues. Some prominent researchers organized joint laboratories abroad. In fact that structures are foreign branches of Russian R & D Institutes. This tendency can be considered as positive from the point of view of world science, because the best researchers continue to contribute to the development of scientific knowledge.

3. For young researchers the situation changed as well. If 2-3 years ago young researchers left science for another sectors of the economy inside the country, now they try to leave abroad. Most institutions have point out that the main reasons for young researchers to leave abroad are not only the level of salary, material and informational conditions of research work, but also such a pure economic reason as inability to receive dwelling. Possible ways out from this situation, work abroad on the basis of 2-3 years contracts, after which it could be possible to improve living conditions ; or leaving science for business for the same period of time. Each possibility is not a good decision : in the first case it usually leads to brain drain, in the second, to loss of scientific qualification and to inability to continue career in science.

Today, it becomes common place that the most talented young scholars try to continue their education abroad. For example, Institute of Spectroscopy RAS is a basic institute for the chair of quantum mechanics of the Moscow Engineering and Physical Institute. The chiefs of the institute indicated that during the last three years all graduating students from this chair have left abroad. So young researchers not only leave science, the worst is - they do not come to work in science. As a result the share of young researchers at these institutes is permanently decreasing. For instance, at the Institute of General Physics RAS among 1025 researchers only 24 are of age under 30 ; at the Institute of Spectroscopy RAS among 11 researchers who left abroad all are under the age of 35.

4. Both researchers and administrative staff consider grants from Russian and foreign foundations as a factor which prevents the outflow of specialists especially in its “hidden” form, when researchers have part-time job outside of the science sector. At the same time grants is a form of individual support. As a result some researchers and research team become more successful, some less. The financial position of different laboratories inside one institute begins to differ as well. In some institutions it leads to desorganization of an institute as a whole organism. Sometimes institutes continue to exist as a formal structures while each laboratory in fact is a small independent institution. In such situation grants influence much on the subject orientation of each laboratory. It becomes difficult for the institute to provide the common science policy

Such measure as grant support can not compensate the lack of federal support, from a financial and from a general point of view. Usually there are more chances to receive grant support for those directions of research which have good background and the results of which are easy to forecast. At the same time today, according to assessments of the chiefs of some institutes, grants cover about 10 % -20 % of expenditures which are necessary for implementation of a given research project [11]. As a result, the effectiveness of grant system as a measure for preventing brain drain is less than it could be.

Some economic conditions in fact favour the brain drain process. That is taxation and custom policy of the government. According to rules currently in force import duty for scientific equipment is very high. So institutes cannot afford to import equipment temporarily so that to conduct research in Russia As a result, institutes have to send researchers to work for some period of time abroad. Especially dramatical situation is in the institutions with predominant share of experimental works.

6. In modern economic environment in Russia the predominant number of the institutes consider work abroad during short periods of time as the most acceptable form of survival for researchers, on the one hand, and as the means of preserving the national scientific potential, on the other hand. According to the results of the survey, the optimal duration for a work abroad is 3-4 months. At some institutes (for example, at the Institute of Hydrodynamics Siberian branch of RAS) according to internal regulations the chiefs of laboratories are prohibited to work abroad more than 3 months. Practice showed that if the chief of laboratory is abroad more than 9 months the level of governing is dramatical decreasing. Finally it influences on the quality of research work.

7. Another interesting example is given by the Institute of Applied Physics of RAS in Nizhny Novgorod. On the basis of this Institute in 1994 a new organizational structure, the International Center-Foundation for Advanced Research was created. The novelty of this organizational form is in *attracting foreign researchers and lecturers to Russia on the basis of grants*. Sponsors of this Center-Foundation are ISF (George Soros) and local administration. They financed in equal portions ($45.000) the first year, 1995, of the Center´s activity. Financial support may be received on the basis of competition for conducting joint projects in the fields of mathematics, physics, chemistry, biology and economics. The joint research team *must* include young researchers and/or graduate students. The scale of activity of this Center is local, oriented on the needs and the demands of Nizhny Novgorod region. But it is extremely important, as for the development of regional science, as for the preventing brain drain process and specially the outflow of young researchers. During the first year grants were awarded in physics, chemistry and biology (medicine). In every project, from the Russian side there were undergraduate and/or graduate students. The Center influenced the situation at the institute : the mobility became positive, and there was no increase of the share of those who left abroad on the basis of long-term contracts.

Statistical data collected during these sample surveys showed that some organizational and financial forms influence positively the reduction of the brain drain. Such centers of international cooperation and financial support in the form of grants in the territory of the Russian Federation. In most cases such structures appear spontaneously.
At the same time the status of Federal Research Center does not influence much on the mobility of scientific personnel. The situation in each Center depends mostly on internal conditions at each institute, its specialization, directions of research, etc.
Long-term contracts still remain the first step to the emigration of researchers as well as catalyst of "informational" emigration.

In conclusion it may be said that the problem of brain drain from Russian science remains very actual and should not be left to develop "naturally", i.e. without any regulations at government level. All federal measures which can influence the outflow process are uncoordinated at present time. The way out is not only in the increase of the level of financing of science but also in stimulation of the variety of the sources of support for science and in the transformation of the system of indirect regulations in the economy.

The brain drain situation from Russia is unique. Russia had a large and strong science sector and now the level of research continues to be high and the level of the economy is inadequate. Real "brains" will be demanded by the economy in a very long perspective when positive changes happen in all economic environment in Russia.

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4 Vestnik RGNF, N2, 1996, p. 74.

5 Liternatunaya gazeta, no 33, 14.08.1996, p. 13

6 Science in Siberia, no 12, 1996, p.9.

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8 All countries are listed in descending order by the number of researchers who visited a given country in 1995.

9 In general there is no “average age” of those who leave for abroad. In most number of institutions which participated in the surveys the most mobile are researchers at he age 31-40 and 42-50 years old. It is not a good indicator : it shows that now Russian science is losing “the middle link” in the structure of scientific personnel and in this way there is forming a gap between youngest and oldest.

10 Almost the institutions participated in the surveys indicated that 100 % of those who leave for abroad on the basis of contracts stay in touch with their home institute.

11 That is an assessment of the institutes which have grants from ISF, INTAS, ISTC, Russian Foundation for Basic Research.

Emigration: Effects on the Structuring of the Algerian Scientific Field

Hocine Khelfaoui 

Scientists, considered as a socio-professional category, have acquired a paramount importance in the dynamics of development. Their role has particularly heightened these past years due to changes in production and to the union of science and manufacturing techniques. These changes have had two major effects :

- passage from competition based mainly on productivity, costs and mass production to competition where quality, innovation and product customization are the key elements of success ;
- implication of scientists as production agents since capacity for constantly innovating or creating new products determine success or failure of an enterprise.

Within these new conditions of competitiveness, scientists become a central element for private enterprises or States competing in the world market. One of the results of this transformation is the increased international mobility of this category of personnel.

The migratory flow resulting from this is a function of the attractiveness of each country. This flow starts in countries that, despite their current level of development, have not *seized* the opportunity of these trends or have perceived it but have been unable to use them, due, particularly, to the nature of social power. Regardless of the level of development achieved before these transformations, the migrations flow arrives in those countries that have understood their importance and managed to attract such a flow.

Those characteristic aspects of migration of scientists these past years make it different from classic forms of migration, whose determinants were not much different from those of other socio-professional categories. They also explain its extent at a time when frontiers have become increasingly sealed off for other types of migrant populations.

Perception and evolution of scientists emigration in Algeria

In Algeria, it seems that the significance of this factor has been realized taking into account the importance the “ brain drain ” theme has taken on in the media, in the official policies and in the opinion of the ordinary man. Although its significance is probably not greater than in other countries in the Mahgreb region or in the Arab World [1], its impact on public opinion has been important.

Accordingly, in recent years, the subject has been dealt with practically every day by the private or public press and written or audiovisual media. But decisions, both in private enterprise and in universities, continue to be, to a great extent, dominated by bureaucracy. Bureaucrats continue to hinder every attempt to give value to this resource and contrary to the wish of some, do little to obtain cooperation from scientists settled abroad or to create conditions for a “ reverse brain drain ”.

Hence, migration of scientists has grown considerably over the past few years. This migration is mainly treated as an irreversible loss for Algeria and it ‘s rarely considered as having potential benefits for the country.

At least two reasons explain this attitude :

- the phenomenon of emigration of scientists is often treated as an argument to illustrate the failure of the country’s management methods, at all levels : State, Universities, private enterprises... When considered this way, the problem has, to a certain extent, been dealt with in a mere utilitarian way ;
- the phenomenon is a veritable trauma for Algerian society. This society, at least since independence, has maintained a special, almost mythical relationship with education and knowledge. This is demonstrated by the social importance and the expenses parents have invested in their children’s education. Nevertheless, admitting emigration of scientists as a mere fact is tantamount to conceding that those endowed with knowledge are not welcome in Algeria. It could be said that with emigration a whole dream vanishes.

But what is this emigration exactly like and how has it evolved throughout history ? Emigration of scientists, if we consider the post-independence period, has gone through three different stages varying according to the causes at the start and the number of migrants.

The first period went from 1962 to 1975. During these years, except for physicians who settled abroad in order to practice privately their profession [2], the phenomenon was not significant, and among migrant scientists many were political exiles. During this period, the exodus was actually induced by the political system or by opposition to this system. For practically all exiles the host country was France.

The second period went from 1975 to 1986. It was the period when a massive number of students were granted scholarships by the Algerian State to go abroad and obtain high-level and post doctoral education. Scientists who emigrated at this time were mainly former scholarship holders having studied abroad. The scope of countries to which they emigrated widened, covering mainly the United States, and to a lesser extent Canada, England and Belgium. The main reasons for choosing the United States as the main host country were the intensification of economic relations with this country at that time and the attraction it exerted on those prone to emigrate. This period was then characterized by the diversification of countries of immigration and the considerable boost in the number of migrants.

The third period began in 1986, the epoch when social-political antagonisms grew and were exacerbated. The flow of migrants increased even more significantly and began to involve scientists trained completely in Algerian ; countries such as Canada and England become preferred destinations.

After this brief look at the perception and the evolution of this emigration, our paper will try to assess its impact on the structuring of the Algerian scientific field. First, we will deal with the effect emigration has on the two main institutions that consume knowledge and know-how, that is the university and the industrial enterprise. Secondly, we will study its impact on the process of building a “ national scientific field ”.

Effects on institutions

After going through a phase whose results will not be discussed here but that can be characterized as a “ founding ” period, both university and private enterprise began to foresee the need for scientific research as well as for research and development activities. It was, paradoxically, at this moment that emigration of scientists increased.

Consequently, the successive departures of scientists to other countries placed the universities and the private firms in the restrictive position of being obliged to continuously replace their personnel. Hence, they became, according to a current expression, “centers for training and personnel development for the benefit of immigrant countries”

International scientific mobility continues because Algerian universities and private firms have little or no attraction. Accordingly, they are constantly starting over, having to perpetually substitute a part of their personnel.

Through this process, a number of institutes and universities steadily lose their personnel. Recently, the migratory flow has become so significant that the term currently used to describe it is “ hemorrhage ” [3].

As for private enterprises, many of them, “ overwhelmed ” by these desertions but unwilling to find out the cause, have decided to resort to the only management method they know : administrative coercion ; they require the deserters to reimburse the money they have spent for their education and stay abroad.

This information, which concerns mostly people having already worked in Algeria in a certain profession, gives an idea of the importance of this exodus. More significant is the exit of young students that have not yet begun their professional career in Algeria. Since they are generally single and do not have appealing prospects for their future, they are the principal group that settle abroad at the end of their studies.

Regardless of their motivations for these departures, the result is a “ de-structuring ” effect on the Algerian scientific community. Many projects undertaken by universities and institutions are aborted or are always under threat of being interrupted, due to the departure of their promoters. An example of this has been given to us by a university head of department. He declares being strongly concerned because he thinks his project of creating a section in “ robotics ” may fall, as he is “ certain ” the students he has sent abroad to be trained for implementing the project “ are very probably going to remain there ”.

Neither universities nor private firms, at least during their period of establishment, have paid any attention to research, whether basic or applied ; this explains, at least partially, their incapacity to integrate scientists. As for universities, this lack of interest may be explained by the fundamental mission they were given ; they had to worry less about excellence and more about training thousands of professionals who were supposed to make the public administration and economic structures to function.

As for private enterprises, during this period, their concern with respect to human resources was limited, at the most, to professional training. Created without Algerian the participation of scientists, through “ ready-to-use contracts ” and “ ready-to-use products ”, Algerian private enterprises did not feel the need for Research and Development, and hence for scientists, as long as it was easy to import equipment.

Many scientists, now settled abroad, were paid by private enterprises for their training in foreign universities. This was prompted by the logic of the need of acquiring professional training and was also linked to the fact that professional training, at that moment, had become an end in itself, unrelated to a previously identified need.

At a certain level, the frontier between research and training is no longer present and those who train abroad often come back with research qualifications. When they do not find activities compatible with their new ambitions, they are obliged to emigrate. During the period leading up to 1986, by resorting to importing procedures and technology, private enterprises did not worry about identifying the tasks local researchers could undertake so as to mobilize this human resource.

It is clear that when needs are assessed, economic and social requirements involving many other factors must be taken into account : a strong demand for researchers and a possibility of selecting them, competition among companies, need for a farsighted management that accepts investing in Research and Development. All these conditions were practically absent from the Algerian market, up to recently.

In fact, during this period, private enterprise was concerned only with training engineers and technicians to run its equipment. Renewal or improvement of this equipment was only envisaged through importation. In industrial circles, discussions were centered not on whether or not to import but rather on the type of technology that should be imported. Research and Development was far from being envisaged as a strategic action, despite the creation of merely symbolic structures called " *Etudes et Développement* " (Evaluation and Development) in some large private enterprises, in a clear imitation of their foreign partners.

During this stage, research as an activity capable of retaining scientists, was abandoned by universities, as the following tables 1 and 2 show :

Grants have been diminishing since 1979, in absolute value, except for the increase from 1981 to 1983 (dates of creation and dissolution of the National Bureau for Scientific Research - ONRS-), meeting structural requirements (bureaucracy) rather than generating new research.

If we consider the erosion of the national currency during this period (Algerian dinar went, according to official exchange rate, from 0.25 $US to 0.05 $US in 1990), this plunge is more significant.

Nevertheless, a number of indexes show that the way private enterprise and universities deal with research is changing notably. Thus, managers are increasingly stressing the importance of

Table 1. Evolution of grants allocated to university research (in 10^3 Algerian dinars)

YEAR	TOTAL AMOUNT	EVOLUTION WITH RESPECT TO 1979
1979	98 500	100
1980	78 000	- 21 %
1981	107 040	8.60%
1982	15 000	16.70%
1983	120 000	22%
1984	50 000	- 51%
1985	48 000	- 51.30%
1986	73 000	- 26%
1987	81 000	- 17%
1988	81 000	- 17%
1989	81 000	- 17%
1990	107 000	8.60%

Table 2. Evolution of the number of researchers and average allocation per researcher (en 10^3 Algerian dinars)

YEAR	TEACHERS-RESEARCHERS	ALLOCATION/ RESEARCHER
1979	807	122
1980	984	79.06
1981	1 189	90
1982	1 377	83.5
1983	1 791	67
1987	2 600	31.15
1988	2 800	29
1989	3 000	37.7

Research and Development for survival of private enterprises. In a number of national-level seminars on the relationship between universities and private enterprise, this trend has clearly been noted. Traditionally, the dominant subject of these seminars was training and they were organized with this goal [4]. However, despite this orientation, the seminar presentations dealt mostly, at times exclusively, with cooperation in Research and Development.

This trend is not due to chance. Several factors explain it :

- the training of management and production staff is no longer a major concern of private firms, since there is a well-developed supply of these available personnel ;
- resorting to importing is increasingly difficult, even impossible, due to financial reasons ;
- with the opening of the Algerian market, the consumer has more choice ;
- since the State no longer intervenes to compensate the free enterprises for their losses, the risk of bankruptcy has become real.

As for universities, the same trend can be observed through a certain number of factors, such as :

- first, the qualitative growth of Algerian universities. After having satisfied its fundamental needs in teachers and after having trained the necessary officials to operate the economic and State structures, Algerian universities must pass to the next stage, that of scientific research ;
- secondly, a factor linked to the need, increasingly remarked by teachers, of dedicating themselves to research. After having accumulated all possible diplomas, teachers' social and professional progression can only be achieved through research. At this stage, if a teacher is not provided the conditions to exercise this function, his choices are reduced to emigration or extra-professional activities. In either case, universities will be prejudiced, although in the latter teachers will continue to practice the teaching profession and to receive their salary.

The third element has to do with the fact that teacher-researchers have already begun to demand that their career progression be no longer based on seniority or diplomas, as has always been the case, but rather on their scientific production (articles, publications, etc.)

Consequently, it is precisely when private enterprises and universities realize the importance of research and expertise and begin to need them [5], that they find that they have to face the competition of the international labor market. It must be stressed that the magnitude of scientists emigration, their successes abroad, along with the attention given by the media to this " potential " achievements has probably contributed to this awareness.

Nevertheless, the impact of scientists' emigration is not only limited to its " de-structuring " effects on university institutions and its consequences for the Research and Development projects undertaken by private enterprises. This emigration will also contribute equally to slow down and to pervert the process of scientific accumulation in Algeria. This is taking place at a time when material and human resources required for this process were being met.

Emigration and science development in Algeria

One of the major effects of this migratory flow lies in its influence on the scientific and technological accumulation process and its corollary : the building of a national science. This impact appears clearly through the relationship between national and international science. This relationship has two aspects. The first one, concerns the reinforcement of the predominance of international logic over the national one. The second aspect, a corollary of the first one, is scientific dependence of university institutions and their determination by outside realities.

Emigration of scientists has had an important effect, though not a fundamental one, in questioning the role played by the State in the building of what could be called a " national science ". We use this term to refer to knowledge, indeed always universal knowledge, adapted to the economic and technological context of Algeria. Having an appropriate scientific base was a concern of Government since the country's independence. In fact, since that time, the State has established goals taking this into account, particularly through the school system. These goals were later stated twice : first, at the launching of the National Institute of Technology (in 1969), and then, secondly, when the Higher Education Reform was carried out (in 1971).

Accordingly, sending students abroad to be trained should guarantee an opening and a means of access to universal knowledge and, at the same theme, should be a complement for the training offered in Algeria. However, sending students abroad should not have a definite influence on the orientation of local universities. Nevertheless, contrary to what had been planned, education abroad and scientists emigration did influence university policy. As for education abroad, Algerian university authorities, for a number of reasons, have been unable to guarantee the students scientific follow up. This has led most of them to bend to the needs of the host laboratories and to choose research options and subjects with little relation to the profile they had acquired at their institutions of origin.

In developed countries, beyond the idea of " internationalization of science " and " universality of knowledge ", universities follow a strategy determined by the State and the application of which is greatly due to the convergence of interests of scientific institutions and industrial and trading enterprises. Following this strategy, research orientation is compatible with the needs of local enterprise. In this context, students abroad are often compelled to treat subjects in relation to the host country's policies. This imbalance between needs of the country of emigration and those of the country of immigration has various causes : sometimes it is due to the technological gap, sometimes to local industry's needs (since it finances the laboratories), or it is simply due to socioeconomic or climatic differences.

A foreign researcher or a student lacking a follow up or a support from his country of origin has no choice but to follow this orientation, and thus, adapt himself to the host country's science system. All students admit having had to face this problem. Very often the subjects they end up investigating turn out to be practically inadequate to the needs of the university they come from ; these needs are incidentally, poorly defined, since these universities lack coherent development projects.

Nearly all researchers settled abroad who were interviewed admitted or emphasized the existence of a technological or socioeconomic imbalance between the work they do and what they will be asked to do at their return to Algeria. Even if many of them minimized the importance of this, they admitted that if they had to continue their scientific career in their own country, they would need to review their approach and their specialty. Here are just two of the many examples of this : a researcher in veterinary sciences sent to England to study parasitology, a specialty much in demand in Algeria, ended up working on pets " nervous system " ; another researcher in Canada undertook a project on frozen soil...

A researcher engaged in this type of work finds himself in this situation : on the one hand, he limits his chances of being able to pursue and to deepen his research back in Algeria, but on the other hand, he increases his possibilities of being hired in the host country. This situation leads either to emigration or, in case of return, to foreign-oriented trend in Algerian universities.

Upon the student or researchers' return, there is a resulting tendency towards foreign-orientated research and a limitation in the process of emphasizing the " endogenous " component of knowledge. Consequently, universities are increasingly turning to " International science ". Robotics, electronics, computing sciences and other high-value areas in the international market, are relegating classical technologies and, at the same time, devaluating them socially.

Throughout the years, the process of scientific accumulation has been notably reoriented. International logic tends to have priority over the national logic ; the outlines of this logic were given by the State-determined policy followed in Algeria in the 60's and the 70's. But international logic is, in fact, nothing but the country of immigration's logic ; there is not (yet ?) an international logic in itself, despite the intensification of scientific exchanges and the multiplication of researchers networks. Even the scientific policies in industrialized countries, despite trends towards homogenization due to the intensification of exchange networks, keep being characterized by the particularities of one country or another, as many OCDE studies have shown**.**

The Algerian scientific policy has been weakened by the influence of bureaucracy over functional structures, by the predominance of administration over science, and of politics over technology ; as a result, it has lost all the capacity to defend options related to local realities. At the level of scientific institutions, there are practically no longer any global and coherent policies due to bureaucracy's having weakened its structures, to State's retreat and to the expansion of individual or group strategies. Therefore, at this level there is nothing left but conflict of " schools " or rather of sociocultural regions, conflicts that are expressed in the linguistic domain but mostly in the methodological one. Advocates of different -schools Anglo-Saxon, French, Soviet... , including those from the Algerian school- oppose each other, according to the country of immigrations or the country where higher education was obtained (the effect is just about the same). Each group tries to defend the system from which they come.

Anglophiles praise " pragmatism of Anglo-Saxon way of working " ; francophiles reply by stressing " their school's capacity for abstraction and its independence from secondary considerations ", Russophiles stress that " in fifty years, Soviet science has allowed that country to pass from feudalism to the conquering of space ", though they make a distinction between the scientific and political systems. In terms of academic controversy, these confrontations could be useful for scientific development. Nevertheless, they deal more often with questions related more to power than to knowledge. In fact, the conflict between these groups concerns more obtaining administrative control of the institutions than scientific production in itself.

Throughout the years, national scientific policy has given way to a series of orientations determined by the countries where scientists have studied and/or worked before returning to Algeria. Officially, the State is the only one to decide on the national policy on scientific development ; yet, reality of the field is dominated by multiple strategies which determine to a large extent the orientation of each institution and specialty. Sometimes, within the same institution, even within the same specialty, the orientation is not homogenous.

It is true that the State's lack of commitment is not only due to the impact of migrants. National policy on science has never been coherent. Divergent centers of power confront each other over it, sometimes quiet strongly, while in the field " theoreticians " and " pragmatists ", " university graduates " and " technologists " dispute the legitimacy of the knowledge. What is new in this confrontation can be summarized as follows :

- there is a predominance of antagonism in the very field over the ones that are taking place in the high-level administration ;
- on the field, scientists are increasingly distinguished by their country of immigration.

Conclusion

Scientific emigration is tending to become the dominant form of labor mobility in the international market. Given the association of science with production techniques and its role in competition, scientists are economic agents of great importance for success in private enterprises.

In this context, international labor mobility is disadvantageous for countries that, like Algeria, have started from zero (at its independence) and have just begun to build its basic industrial and scientific infrastructure. As a result, the impact of this emigration can be seen at three levels : basic institutions, scientific policies and relationship between society and knowledge.

At the institutional level, scientific emigration, due to the expansion it has had from 1986 on, has had a distorting effect on universities and private enterprise. It has acted, notably, as a " destructuring " element in scientific institutions and has orientated them towards foreign realities ; at the same time, it has been an obstacle to the private enterprises' undertaking of Research and Development projects.

On a more global level of scientific policy, this phenomenon has contributed to the emergence of an international logic, or rather several types of international logic that tend to replace national orientation of scientific development. This policy is to a certain extent decentralized at the level of basic institutions where it is subjected to multiple, often contradictory, strategies.

However, the greatest impact is perhaps that of new attitudes toward science. These attitudes are related to a form of disappointment with respect to knowledge, a disenchantment that has been revealed by scientific emigration. In fact, the latter is perceived by society as the sign, or even the evidence, of the failure of a development project in which knowledge was the main element of social prestige.

Indeed, right after independence, colonization leveled Algerian society in economic and social terms ; consequently, access to knowledge was perceived as the only way to success, as there were no other forms of differentiation. Evidence of this could be seen in the affective attachment Algerians have given to education and the investment they have placed in it. Access of children to education was a broad concern. As a result, after independence, Government had to regularly dedicate to education 30 % of the State budget.

One of the greatest effects of scientific emigration could be the demystification of school's role, beyond knowledge, in strategies of social promotion. For many, knowledge did not turn out to be the key to open the doors to success as, at best, those who possessed ended up in exile.

[1] According to *Tunis-hebdo*, quoted by an Algerian newspaper, only 20 % of all students gone abroad return to their country. According to UNESCO, in Algeria, in 1989, considering the number of these students, the ratio was 10.875 to 16.592.

[2] At this time, medicine was a public service and hence medical attention was free. The opening of a private medical office was rarely authorized.

[3] By way of example, here are some cases, among many, of migratory movements presented in the press : "only fifty (50) students out of seven hundred (700) sent abroad for post-graduate education have returned to their former institution at the end of their studies". (*El Watan*, 06/04/1993) ; "only thirty (30) physicians out of one hundred and sixty (1 60) sent abroad for specialization training have come back to practice their profession in the country. (*Alger-Républicain* 06/04/1992) ; "on the last few years, 70 % of teachers from the Institute de Mathématiques de 1'université d'Alger have returned to the country where they received their advanced education" (*Alger-Républicain* 06/04/1992).

[4] It was particularly the case of " Reflection on the training of officials on the market economy ", a conference organized by the Enesil company in July 14-15, 1992, in Algiers. " University-private enterprise : what are the relations?", a national-level seminar organized by Development and Promotion of Science and Technology, in January 19-20, 1993, in Algiers.

[5] The oil company Sonatrach is now demanding former scholarship holders, whose specialisation abroad it had sponsored in the past, to come back from the countries where they have settled themselves and to work with the company. In case of refusal they demand the reimbursement of the education fees.

Émigration : effets sur la structuration du champ scientifique algérien

Hocine Khelfaoui

Le but de cette contributions est de proposer à la discussion quelques-uns des effets de l'émigration des scientifiques sur l'université et l'entreprise algérienne. Je pars du constat que le champ scientifique n'est plus seulement constitué de l'université et des institutions traditionnelles de recherche, mais également - et de plus en plus - de l'entreprise, champ d'expérimentation d'un savoir produit soit par elle-même, dans ses propres centres de recherche appliquée, soit au sein de l'université.

Les effets traités sont ceux qui sont induits par le départ aussi bien que par le retour. Cette démarche est liée au fait que l'enquête qui est à la base de cet article a été réalisée à une période où les retours de formation doctorale, généralement après quelques années de travail dans les pays d'immigration, étaient assez importants. Cette importance n'était pas seulement de l'ordre du quantitatif. Elle résidait également dans l'influence que ces retours avaient sur le développement scientifique et son orientation. Au moment de l'émigration, le scientifique qui part est un élément qui se détache d'un ensemble. Son départ ne peut donc être sans incidence sur cet ensemble. Au retour, ce scientifique n'est évidemment plus le même qu'à l'aller. Sa réinsertion dans le champ scientifique algérien ne sera pas sans incidence sur celui-ci. On s'efforcera à chaque fois de souligner aussi bien les effets scientifiques que les effets sociaux et économiques, sachant que ces trois niveaux sont interactifs.

Ces dernières années, les scientifiques, en tant que catégorie socioprofessionnelle, ont acquis une importance capitale dans la dynamique du développement. Leur rôle s'est particulièrement accrue en raison des transformations qualitatives que connaît le monde de la production et de la jonction de la science d'avec les techniques de production. Ces changements sont liés à la conjonction de plusieurs facteurs, parmi lesquels il faut citer :

- Le passage d'une compétitivité basée principalement sur la productivité, les coûts et la production de masse à une compétitivité où la qualité, l'innovation et la personnalisation du produit sont les éléments clé de la réussite.
- La réhabilitation conséquente du scientifique comme agent de production dans la mesure ou les capacités d'innover et de créer sans cesse des produits nouveaux déterminent le succès ou l'échec de toute entreprise.

Dans ces nouvelles conditions de compétitivité, le scientifique devient un élément central dans la stratégie des États et des entreprises qui s'affrontent sur le marché mondial. Un des résultats de cette mutation réside dans une mobilité internationale plus grande pour cette catégorie de personnel. Le flux migratoire dominant qui en découle est fonction des capacités attractives de chaque pays.

Ce flux part des pays qui, au-delà de leur niveau de développement actuel, n'ont pas saisi ces tendances, ou bien ceux - qui, les ayant perçu, n'ont pu les concrétiser, en raison notamment de la nature du pouvoir social. Il aboutit dans les pays qui, indépendamment du niveau de développement qu'ils ont atteint avant ces mutations, ont compris son importance et réussissent à réunir les conditions de son attraction.

Ce sont ces aspects qui caractérisent l'émigration des scientifiques de ces dernières années. Ils la distinguent des formes classiques qu'elle revêtait jusqu'à ces dernières années, et dont les déterminants n'étaient alors pas tout à fait différents de ceux des autres catégories socioprofessionnelles. C'est aussi ce qui explique son ampleur au moment où les frontières deviennent de plus en plus hermétiques pour les autres types de populations migrantes.

Perception et évolution de l'émigration scientifique en Algérie

En Algérie, une prise de conscience de l'importance de ce facteur s'est exprimée ouvertement vers la fin des années 1980. Celle - ci peut être aisément observée à travers la place qu'occupe le thème de la *« fuite des cerveaux »* tant dans les médias que dans le discours officiel ou celui de *« l'homme de la rue »*. Bien que son ampleur ne soit probablement pas plus importante qu'elle ne l'est dans les autres pays du Maghreb ou du Monde Arabe [1], son impact sur l'opinion publique s'est avéré considérable.

Ainsi, il ne se passe presque pas de jour ces dernières années, sans que la presse, publique ou privée, écrite ou audiovisuelle, n'aborde le sujet. Mais dans les entreprises comme dans les universités, la décision reste dans une large mesure dominée par la bureaucratie, qui paralyse tout effort destiné à réduire les causes du flux migratoire. Celle-ci continue à mettre en échec toutes les tentatives de valoriser cette ressource, et encore moins, comme l'espèrent certains, de mettre à contribution, les scientifiques installés à l'étranger ou de créer les conditions rendant possible leur retour *(« reverse brain drain »).*

Aussi l'émigration des scientifiques s'est-elle considérablement accélérée ces dernières années. Cette migration est dans la plupart des cas traitée par les différents discours comme une perte irréversible pour l'Algérie, et il est rare d'entendre évoquer ses éventuelles retombées positives sur le pays.

Cette attitude s'explique par au moins deux raisons :

- Le phénomène de l'émigration des scientifiques est souvent traité en tant qu'argument illustrant l'échec des modes de gestion connus par le pays, et cela à tout les niveaux : État, Université, Entreprise... En ce sens, le problème n'a pas échappé à une certaine instrumentalisation politique.
- Le phénomène constitue un réel traumatisme pour la société algérienne. Celle-ci a, au moins depuis l'indépendance, entretenu un rapport particulier, presque mythique, à l'éducation et au savoir. Ce rapport est corroboré par l'immense investissement affectif et matériel consenti par les parents dans l'éducation de leurs enfants. Or, admettre l'émigration des scientifiques revient au constat d'aveu qu'il n'y a pas de place en Algérie pour les détenteurs du savoir. C'est, pourrait-on dire, tout un rêve qui s'évanouit, celui de l'ascension sociale par l'accès au savoir.

Mais qu'en est-il de cette émigration et comment s'est-elle effectuée historiquement ? L'émigration des scientifique, si l'on s'en tient à la période post-indépendance, s'est déroulée en trois phases se différenciant tant par les causes de départ que par le nombre de migrants.

- La première phase est celle qui va de 1962 à 1975. Durant ces années, à l'exception des médecins qui s'installaient à l'étranger pour pouvoir exercer à titre privé [2], le phénomène avait une allure normale et l'on remarquait, parmi les scientifiques émigrants, surtout les exilés politiques. Pendant cette période, il s'agissait essentiellement d'un exode induit par le système politique ou par la résistance à ce système. Le principal pays d'accueil était presque dans tous les cas la France.

- La deuxième phase est celle qui s'étend de 1975 à 1986. C'est la période des envois massifs d'étudiants en formation supérieure et de post-graduation grâce à des bourses octroyées par l'État algérien. Les scientifiques ayant émigré durant cette période comptaient pour l'essentiel parmi les boursiers ayant fait leurs études à l'étranger. Les pays d'immigration se sont élargis principalement aux États-Unis et au Canada, puis, dans une moindre mesure, à l'Angleterre et à la Belgique, voire parfois le Japon, via les États -Unis...
Le choix des États-Unis, puis dans un deuxième temps du Canada, comme principaux pays d'accueil résulte, entre autres facteurs, de la densification des relations économiques avec ces pays durant cette époque, et à l'attrait qu'ils exercent traditionnellement sur les candidats à l'émigration. Cette période se caractérise donc par la diversification des pays d'immigration et par l'augmentation considérable du nombre de migrants. Le flux de migrants est essentiellement constitué de boursiers du gouvernement algérien qui ne réintègrent pas leurs institutions d'origine à l'issue de leurs études ou qui optent pour l'émigration après l'échec d'une tentative de réinsertion dans le pays d'origine.
- La troisième phase est celle qui débute en 1986, date de la crise de croissance et de l'exacerbation des antagonismes socio-politiques. Le flux des migrants s'intensifia encore plus considérablement et commence à concerner des scientifiques intégralement formés en Algérie. Outre la France, des pays comme le Canada, l'Angleterre deviennent des destinations de choix...

Après ce bref aperçu sur la perception et l'évolution de cette émigration, notre propos est d'en évaluer l'impact sur la structuration du champ scientifique algérien. L'on traitera dans un premier temps de l'effet sur les deux principales institutions consommatrices de savoir et de savoir-faire, l'université et l'entreprise industrielle. On évoquera dans un second temps l'impact sur le processus de constitution d'une « science nationale ».

Effets sur les institutions

Paradoxalement, l'émigration des scientifiques s'est intensifiée au moment où l'université comme l'entreprise, après avoir traversé une phase — avec des résultats qu'il n'est pas de notre propos de discuter ici —, mais qu'on peut caractériser de « fondatrice », commencent à pressentir le besoin d'une activité en recherche scientifique et en recherche - développement.

Aussi, les départs successifs vers d'autres horizons ont mis l'université et l'entreprise dans la situation contraignante d'avoir à renouveler en permanence leur personnel, se transformant, selon une expression couramment usitée à ce propos en *« centre de formation et de perfectionnement »* pour les pays d'immigration.

La mobilité internationale des scientifiques sur laquelle l'université et l'entreprise algérienne n'ont aucune attraction, se fait totalement à leur détriment. De ce fait, elles se retrouvent dans un état de perpétuel recommencement, étant dans l'obligation d'avoir toujours à reconstituer une partie de leur personnel.

Ainsi, nombre d'instituts et d'universités se vident à un rythme soutenu. Ces dernières années, l'importance du flux migratoire est telle que le terme « d'hémorragie » est couramment employé pour le désigner. A titre d'exemple, voici, recueillis dans la presse, quelques cas, parmi tant d'autres, de mouvements migratoires :

- Sur 700 enseignants envoyé en formation post-graduée à l'étranger, seuls 50 ont rejoint leurs établissements d'origine à l'issue de leurs études. (*El Watan* du 06/04/1993).
- Sur 160 médecins envoyés en formation de spécialisation entre 1987 et 1991, 30 seulement sont revenus exercer au pays. (*Alger Républicain* du 06/04/1992).

- Ces dernières années, 70 % des enseignants de l'Institut de Mathématiques de l'Université d'Alger ont rejoint le pays où ils avaient été formés (*Alger Républicain* du 06/04/1992).

Pour leur part, nombre d'entreprises, excédées par les défections de leur personnel envoyé en perfectionnement, ont décidé de demander aux migrants le remboursement des frais d'études et de séjour qu'elles ont engagé pour leur formation à l'étranger.

Ces indications, qui concernent dans la plupart des cas des personnes ayant déjà exercé une activité professionnelle en Algérie, donnent une idée de l'importance de l'exode. Mais l'évasion est certainement plus impressionnante chez les jeunes étudiants n'ayant pas encore entamé de carrière professionnelle en Algérie. Etant généralement célibataires et sans perspective d'avenir attrayante, ils sont encore plus nombreux à choisir à l'issue de leurs études, de s'installer à l'étranger. Il faut souligner que le caractère « massif » de cette émigration, le « succès » réel ou supposé des scientifiques installés à l'étranger, ainsi que le tapage médiatique entretenu autour de ce *« potentiel »*, ont probablement contribué à cette prise de conscience.

Ces départs, quelles que soient leurs motivations, ont un effet déstructurant sur les institutions scientifiques algériennes. Nombre de projets initiés par les universités et les instituts avortent ou sont menacés d'arrêt à tout moment en raison du départ de leurs animateurs. Un exemple nous est donné par ce responsable d'Université ulcéré par l'idée que son projet de création d'une section de « robotique » risquait de ne pas aboutir en raison de sa *« certitude »* que les étudiants qu'il a envoyé en formation à l'étranger pour l'animer allaient *« très probablement y rester »*.

Pour l'Université comme pour l'entreprise, l'absence d'intérêt accordé à la recherche, fondamentale ou appliquée durant leur phase de construction, au profit des fonctions de formation et de production, contribuent à expliquer leur incapacité d'intégrer les scientifiques. Au niveau de l'université ce manque d'intérêt peut s'expliquer par la mission fondatrice qui lui était alors dévolue. Celle-ci devait s'occuper moins de l'excellence ou de l'innovation que de la formation de milliers de cadres destinés à faire fonctionner les structures de l'administration publique et de l'économie.

Au niveau de l'entreprise, s'agissant des ressources humaines, les préoccupations se limitaient au mieux durant cette période à la formation professionnelle. Créée historiquement sans l'apport de scientifiques algériens, par le biais des *« contrats clé en main »* et *« produits en main »*, l'entreprise n'a pas éprouvé, tant qu'il était possible d'importer des équipements sans difficulté, le besoin d'un apport en recherche - développement, et donc de scientifiques.

D'ailleurs, nombre de scientifiques installés à l'étranger y ont été envoyés en formation par les entreprises, et à leurs frais. Mais ces envois ont eu lieu selon la logique de l'acquisition d'une formation professionnelle. Tout comme ils sont liés au fait que l'activité de formation professionnelle était devenue à un moment donné une fin en soi, sans rapport avec un besoin préalablement identifié.

Or, à un certain niveau, il n'y a plus de frontière entre formation et recherche et les candidats reviennent souvent avec des qualifications de chercheur. Ne trouvant pas d'activités compatibles avec leurs nouvelles ambitions, ils sont alors contraints d'émigrer.

Durant toute la phase qui s'étend jusqu'en 1986, le recours à l'importation des procédés et de technologies dispensa les entreprises de tout effort d'identification des besoins susceptibles d'être pris en charge par les chercheurs nationaux et par conséquent de mobiliser cette ressource humaine.

Il est vrai que ce besoin suppose une nécessité économique et sociale à laquelle nombre d'autres facteurs participent : une demande exigeante et ayant le choix de son partenaire, une compétition entre les entreprises, une gestion clairvoyante qui accepte d'investir dans la recherche-développement. Toutes conditions qui étaient plus ou moins absentes du marché algérien jusqu'à ces dernières années.

En fait, l'entreprise ne s'était préoccupée pendant cette période que de la formation des ingénieurs et des techniciens destinés à faire tourner ses machines L'amélioration et le renouvellement de ses équipements n'étaient envisagés que sous l'angle de leur importation. Et, dans les milieux de l'industrie, le débat portait plutôt, jusqu'à la fin des années 70, sur le type de technologie à importer : classique, de pointe… On était loin d'envisager sérieusement l'activité de recherche-développement comme action stratégique, même si quelques grandes entreprises publiques, imitant en cela leurs partenaires étrangères, ont crée symboliquement des structures appelées « *Études et Développement* ».

La recherche, en tant que principale activité susceptible de fixer les scientifiques, a été durant cette phase, tout aussi délaissée à l'Université comme le montrent les tableaux A et B.

Comme il apparaît dans le tableau A, les crédits n'ont cessé d'être, en valeur absolue, en dessous de leur niveau de 1979. Ceci en considérant que les hausses enregistrées de 1981 à 1983 (dates respectives de création et de dissolution de l'Office National de la Recherche Scientifique-ONRS) correspondaient plutôt aux besoins des structures (bureaucratie) qu'à ceux de l'activité

Si l'on tient compte de l'érosion de la monnaie nationale pendant cette décennie (le dinar est passé, selon le cours officiel, de 0,25 $US en 1979 à 0,05 en 1990), la chute des crédits se révèle beaucoup plus importante.

Tableau A. Évolution des credits de fonctionnement affectés à la recherche universitaire (en 10^3 d.a.)

Années	Enveloppe	Évolution par rapport à 1979
1979	98 500	100
1980	78 000	- 21 %
1981	107 040	+ 8.60 %
1982	115 000	+ 16.70 %
1983	120 000	+ 22 %
1984	50 000	- 51 %
1985	48 000	- 51.30 %
1986	73 000	- 26 %
1987	81 000	- 17 %
1988	81 000	- 17 %
1989	81 000	- 17 %
1990	107 000	+ 8.60 %

Ce tableau montre le peu d'intérêt accordée à la recherche pendant la décennie 1980. Alors que le nombre d'enseignants-chercheurs est en progression constante durant cette période, 1a dotation par chercheur décroissait régulièrement. Ces indications montrent par ailleurs la déconnexion qui existe entre ressources humaines et ressources financières. Ces conditions de relégation de la recherche ne peuvent qu'inciter les scientifiques à prendre le chemin de l'émigration.

Tableau B. Évolution du nombre de chercheurs et dotation moyenne par chercheur (en 10^3 d.a.)

Années	Enseignants chercheurs	Dotation chercheur
1979	807	122
1980	984	79.06
1981	1 189	90
1982	1 377	83.5
1983	1 791	67
1987	2 600	31.15
1988	2 800	29
1989	3 000	37.7

Cependant, nombre d'indices montrent que la démarche de l'entreprise et de l'université à l'égard de la recherche est en entrain de connaître une évolution notable. Ainsi, l'importance de la recherche-développement pour la survie des entreprises est de plus en plus soulignée par les gestionnaires. Cette tendance a pu être clairement constatée à l'occasion notamment de plusieurs séminaires nationaux sur la relation Université-Entreprise. Ces séminaires étaient traditionnellement dominés par le thème de la formation et étaient organisés à cette fin [3]. Malgré la persistance de cette orientation, la réalité des interventions portait le plus souvent, parfois exclusivement, sur la coopération en matière de recherche-développement.

Cette tendance n'est pas due au hasard. Plusieurs paramètres participent à l'expliquer :

- La formation des cadres d'administration et de production n'est plus une préoccupation majeure de l'entreprise qui dispose pour cela d'un marché bien pourvu.
- L'importation est un recours de plus en plus difficile, voire impossible, pour des raisons financières.
- Avec l'ouverture du marché algérien, le consommateur dispose de plus de possibilités de choix face à son partenaire.
- Le risque de faillite est désormais réel, l'État n'intervenant plus pour combler le déficit.

Cette évolution concerne également l'Université où elle peut être observée à travers un certain nombre de facteurs :

- Le premier réside dans le saut qualitatif réalisé par l'Université algérienne. Celle-ci, après avoir satisfait ses besoins fondamentaux en enseignants, après avoir formé l'encadrement nécessaire au fonctionnement des structures de l'État et de l'économie, fait face à la nécessité de passer à une étape supérieure, celle de la recherche scientifique.
- Le second est lié au besoin, de plus en plus exprimé par les enseignants, de s'adonner à la recherche. Après avoir accumulé tous les diplômes possibles, leur progression sociale et professionnelle ne peut plus se faire que par le biais de la recherche. A ce stade, et à défaut de lui assurer les conditions d'exercice de cette fonction, l'enseignant n'aura d'autres choix que d'émigrer ou de se lancer dans des activités extra - professionnelles. Dans l'une ou dans l'autre situation, ce déploiement se fera au détriment de l'université même si dans le second cas il continuera à exercer le métier d'enseignant et à percevoir son salaire.
- Le troisième facteur peut être rattaché au fait que les enseignants - chercheurs commencent déjà à exiger que la progression de carrière ne se fasse plus à l'ancienneté ou au diplôme, comme cela a toujours été le cas, mais au vu de la production scientifique (articles, publications...).

Le passage de l'université et de l'entreprise à cette phase qualitative, qui est celle de la recherche scientifique, ne s'est pas effectué, comme le fut la phase quantitative, de manière volontariste. Il s'est objectivement imposé comme un besoin induit par la poursuite du processus de croissance. Contrairement à l'activité de production industrielle (en entreprise) et à celle d'enseignement (à l'université), dont le développement est le résultat de l'action volontariste de l'État, l'activité de recherche scientifique s'est développée grâce à l'initiative des acteurs de base. L'institutionnalisation de la recherche scientifique est d'ailleurs toujours l'objet de débats au niveau officiel, et, jusqu'à ce jour, cette activité n'est toujours pas dotée d'un statut officiel.

C'est donc au moment où l'entreprise et l'université découvrent la recherche et l'expertise, ou plutôt commencent à en éprouver le besoin [4], qu'elles subissent de front la concurrence du marché international du travail. La « crise économique » et « la fuite des cerveaux » se sont donc produits quasi-simultanément. Cependant, ils ont coïncidé plus qu'ils ne se sont déterminés l'un l'autre. En effet, il semble que la « fuite des cerveaux » est bien plus le résultat de l'utilisation généralisée de la science comme outil de production, sur le marché mondial du travail, qu'elle n'est liée à la « crise économique » même si celle-ci en a parfois accentué les traits. La jonction totale de la science et de l'économie, conjuguée à leur mondialisation, ont créé une nouvelle situation de concurrence internationale. Un des résultats de cette situation est l'incapacité des pays, dont le système socio-économique est à faible compétitivité, d'attirer ou de garder les scientifiques, devenus des agents économiques très sollicités sur le marché mondial.

Mais, l'impact de l'émigration des scientifiques ne se réduit pas seulement à ses effets déstructurants sur les institutions universitaires, et à ses retombées sur les projets de recherche-développement initiés par les entreprises. Cette émigration contribuera également à ralentir et à pervertir le processus d'accumulation scientifique en Algérie. Ceci au moment même où les conditions matérielles et humaines préalables à ce processus ont été réunies.

Émigration et développement de la science en Algérie

Un des effets majeurs de ce mouvement migratoire réside dans son influence sur le processus d'accumulation scientifique et technique et son corollaire la construction d'une science nationale. Le concept de « science nationale » ne s'entend pas ici au sens géographique, ethnique ou politique, mais « technique », voire même « scientifique ». Comme toute pratique sociale, comme toute culture sociale, pourrait-on dire, la science comporte des aspects universels s'exprimant à travers des lois générales et des aspects spécifiques liés à la diversité des formes concrètes de sa mise en oeuvre pratique. Elle est de ce fait universelle dans ses principes, mais spécifique dans les modalités de son application. Pascal a déjà souligné cette relativité de la science, l'exprimant en une seule phrase, devenue depuis célèbre par sa simplicité et sa pertinence : *« Vérité en deçà des Pyrénées, erreur au-delà »*.

L'impact de ce mouvement migratoire se révèle donc notamment à travers le rapport entre science nationale et science internationale. Les migrants reviennent souvent avec des préoccupations scientifiques correspondant aux besoins de l'ancien pays d'accueil. Ces préoccupations sont généralement orientés vers les technologies de pointe (informatique, robotique...) alors que la demande des entreprises établies relevait de technologie plus classique. Ce problème, qui est peut-être spécifique à l'Algérie, est lié au fait que l'industrie existante ne s'est pas développée dans le même contexte technologique que le potentiel scientifique humain. L'industrie date de manière générale des années 1960 et 1970, les scientifiques sont, eux, de formation plus récente et conçue pour les besoins des pays avancés.

Le retour des scientifiques formés ou établis à l'étranger met l'université et l'entreprise algériennes en contact et en compétition directe avec la science internationale. A ce niveau, l'impact est perceptible à travers le rapport entre la logique de la mondialisation, véhiculée par la dimension universelle de la science, et la logique locale définie par la manière particulière dont les problèmes économiques et sociaux se posent à chaque pays, ou, si l'on veut, à travers le rapport entre la logique internationale et la logique nationale. Il est vrai que cette double logique s'incarne à travers la démarche étatique qui prétend représenter la science nationale et les comportements professionnels des individus et des groupes, dont les intérêts scientifiques et matériels sont de plus en plus liés à la science internationale.

La logique étatique peut être identifiée à travers les orientations que l'État tente d'imposer aux universités et aux entreprises publiques, et au-delà, aux acteurs de la science, c'est-à-dire aux scientifiques. La logique individuelle ou de groupe peut, elle, être identifiée à travers les stratégies individuelles et les stratégies de groupes. La convergence entre la démarche étatique et celle des acteurs de base est de moins en moins évidente, lorsqu'il s'agit des scientifiques ayant eu une expérience professionnelle à l'étranger.

De ce fait, et sans être le seul facteur déterminant, l'émigration des scientifiques a eu un effet important dans la remise en cause du rôle de l'État algérien dans la construction de ce qu'on pourrait appeler par commodité de langage, une « science nationale ».

Par science nationale, on entend ici un savoir, certes universel, mais adapté au contexte économique et technologique algérien. Cette science appropriée était une des préoccupations des pou-

voirs publics depuis l'indépendance du pays. En effet, l'État avait dès cette époque tenté d'arrêter des objectifs tenant compte de ce contexte, notamment à travers le système d'enseignement. A ce titre, les envois en formation à l'étranger devaient assurer une ouverture et un moyen d'accès au savoir universel tout en étant un complément pour l'enseignement dispensé en Algérie. Ils ne devraient pas influencer de manière décisive ou déterminer l'orientation de l'université.

Les objectifs du projet scientifique national avaient été explicités par la suite à deux reprises : à l'occasion du lancement des Instituts Nationaux de Technologie (en 1969) et lors de la réforme de l'enseignement supérieur (1971).

La rencontre entre le projet scientifique national et la science internationale, que l'émigration des chercheurs a permis, a mis en évidence deux aspects :

- Le premier est relatif au renforcement de la science internationale, donc des logiques à tendance mondialiste, portée par les stratégies individuelles et de groupes.
- Le second, corollaire du premier, est la dépendance scientifique et l'extraversion des institutions universitaires, dont la démarche est de plus en plus intégrée à la science internationale.

Cette ouverture est pour l'essentiel menée par les scientifiques qui ont pratiqué la recherche à l'étranger soit dans un cadre professionnel, soit lors de la préparation d'une thèse de doctorat.

Or, contrairement à ce qui a été prévu, la formation à l'étranger et l'émigration scientifique vont influencer la politique scientifique officiellement suivie, avant de l'amener ces dernières années à céder complètement face aux stratégies individuelles et de groupes. Concernant la formation à l'étranger, les autorités universitaires algériennes se sont avérées, pour des raisons multiples, incapables d'assurer un suivi scientifique aux étudiants. Ceci a conduit la grande majorité de ces derniers à se soumettre aux besoins des laboratoires d'accueil et de choisir des options et des thèmes de recherche peu en rapport avec les profils demandés par leurs établissements d'origine.

Car, dans les pays avancés, au-delà du discours sur *« l'internationalisation de la science »*, qui est au demeurant un processus réel et indéniable, mais un processus dont l'accélération est très récente, au-delà donc de ce discours sur *« l'universalité de savoir »*, les universités travaillent conformément à une stratégie dont les grandes lignes sont définies au niveau de l'État et dont l'application est grandement redevable à la convergence d'intérêts entre les trois partenaires nationaux que sont les institutions scientifiques, les entreprises industrielles et commerciales et l'État. La science étant devenue un outil d'expansion économique, on sait que le rôle de l'État national, au moins sur le marché mondial, est encore loin d'être éteint.

Cette stratégie imprime par exemple à la recherche une orientation compatible avec les besoins des entreprises locales. Dans ce contexte, les étudiants à l'étranger, qu'ils aient ou non l'intention d'émigrer, sont souvent contraints de traiter des sujets qui s'insèrent dans la logique du pays d'accueil. Le décalage entre les besoins du pays d'émigration et ceux du pays d'immigration est d'origine assez diverse : tantôt elle est lié au gap technologique, tantôt aux préoccupations de l'industrie locale (qui finance le laboratoire), ou encore plus simplement aux différences de données socio-économiques ou climatiques.

Le chercheur étranger, ou l'étudiant qui ne bénéficie pas d'un suivi ou d'un soutien scientifique de son pays d'origine, ne peut que s'aligner sur cette orientation, et ce faisant, il ne fait que s'adapter au système scientifique du pays qui le reçoit. Tous les étudiants admettent avoir été confrontés à ce problème. Dans nombre de cas, les sujets qu'ils finissent par traiter s'avèrent peu adéquats avec les besoins de leur université d'origine, lesquels sont par ailleurs mal définis en raison de l'absence chez ces dernières de projets de développement cohérents.

La presque totalité des chercheurs installés à l'étranger et interviewés reconnaissent, ou soulignent d'eux-même, l'existence d'un décalage technologique ou socio-économique entre les travaux qu'ils mènent et ceux qu'ils seraient appelés à faire en Algérie. Même si beaucoup en minimisent l'importance, ils affirment que si leur carrière scientifique devrait se poursuivre dans leur pays d'origine, ils devraient pour être bien utilisés, revoir leur approche et leur mode de spécialisation.

Les exemples de ce type sont nombreux : tel ce chercheur en sciences vétérinaires envoyé en Angleterre pour des études en parasitologie, spécialité très demandée en Algérie, qui finit par travailler sur *« le système nerveux »* chez les animaux de compagnie ; ou cet autre qui entreprit au Canada des recherches sur le *« sol gelé »*

Le chercheur qui s'engage dans ce type de travaux se met dans la situation suivante : d'une part il réduit ses chances de pouvoir les poursuivre et les approfondir en Algérie, mais d'autre part il augmente ses possibilités d'être employé sur place s'il est étudiant. Cette situation conduit soit à l'émigration, soit à l'extraversion de l'université algérienne en cas de retour.

Il en résulte donc, à partir des cas de retour d'étudiants ou de chercheurs une tendance à l'extraversion et une certaine limite au processus d'endogénéisation du savoir. L'Université est, notamment de ce fait, de plus en plus tournée vers la *« science internationale »*. La robotique, l'électronique, l'informatique… et autres filières ultra-valorisées par le marché international, prennent le pas sur les technologies classiques tout en les dévalorisant socialement.

Au fil du temps, le processus d'accumulation scientifique s'en est trouvé sensiblement réorienté. La logique internationale tend à l'emporter sur la logique nationale dont les contours avaient été tracés par la politique volontariste suivie par l'État durant les décennies 60 et 70. Mais la logique internationale n'est en fait rien d'autre que la logique du pays d'immigration car il n'existe pas (encore ?) de logique internationale en soi malgré l'intensification des échanges scientifiques et la multiplication des réseaux de chercheurs. Même les politiques scientifiques des pays industrialisés restent, malgré les tendances homogénéisantes induites par la densification des réseaux d'échange, marquées de particularismes d'un pays à un autre comme le montrent les nombreuses études de l'OCDE.

La politique scientifique algérienne, déjà affaiblie par la mainmise de la bureaucratie sur les structures fonctionnelles, par la subordination du scientifique à l'administratif, du technique au politique, a perdu toute capacité de défendre des options en rapport avec les données locales.

Au niveau des institutions scientifiques, il n'y a pratiquement plus de démarche globale et cohérente tant en raison de l'affaiblissement de leurs rouages par la bureaucratie qu'en raison du retrait de l'État et de l'irruption de stratégies individuelles et de groupes.

Sur ce terrain donc, il n'y a plus que des affrontements « d'écoles » ou plutôt d'aires socioculturelles, qui s'expriment sur le champ linguistique mais surtout méthodologique. Selon le pays d'immigration ou de formation -ici la formation à l'étranger donne à peu près le même effet-, les tenants des différentes écoles (anglo-saxonne, française, soviétique) auxquels s'ajoutent les produits de l'école algérienne, s'affrontent. Chacun tente de valoriser au mieux le système dont il est issu.

Les anglophiles font l'éloge du « pragmatisme » de la démarche anglo-saxonne, les francophiles leur répliquent en soulignant les capacités « d'abstraction » de leur école et son indépendance à l'égard des contingences, les russophiles rappellent que « la science soviétique » a permis en 50 ans à ce pays de passer de l'âge du servage à celui de la conquête de l'espace, en prenant soin de distinguer entre système scientifique et système politique.

En tant que débat « d'école », ces confrontations auraient pu être fructueuses pour le développement de la science. Mais le terrain sur lequel elles se déroulent est moins celui du savoir que celui du pouvoir. En effet, ces groupent s'affrontent plus souvent pour le contrôle administratif des institutions scientifiques que pour la production scientifique.

Au fil du temps, la politique scientifique nationale a cédé le pas devant une multitude de démarches inspirées des différents pays où un grand nombre de scientifiques ont été formés et/ou ont travaillé avant de rentrer en Algérie. Si, officiellement l'État reste seul décideur de la politique nationale de développement, la réalité du terrain est dominée par des stratégies locales multiples, qui déterminent dans une large mesure l'orientation de chaque établissement, de chaque spécialité. Parfois, à l'intérieur d'un même établissement, voire d'une même spécialité, la démarche n'est pas homogène.

Certes, on ne peut attribuer le désengagement de l'État au seul impact des migrants. La poli-

tique nationale en matière de science n'a en fait jamais été cohérente. Des centres de pouvoir divergents s'y affrontaient parfois durement tandis que sur le terrain « théoricistes » et « applicateurs », « universitaires » et « technologues » se disputent la légitimité du savoir.

Ce qu'il y a de nouveau dans ces antagonismes peut se résumer ainsi :

- Les antagonismes de terrain tendent à l'emporter sur ceux qui se déroulent au sein de la haute administration.
- Sur le terrain, les scientifiques se distinguent de plus en plus en fonction des pays d'immigration.

Conclusion

L'émigration des scientifiques tend à devenir le type dominant de mobilité du travail sur le marché international. La jonction de la science d'avec les techniques de production, son rôle dans la compétition, font des scientifiques des agents économiques de premier plan pour le succès des entreprises.

Dans ce contexte, la mobilité internationale du travail s'avère défavorable aux pays qui, comme l'Algérie, sont partis de zéro à l'indépendance, et qui viennent à peine d'entamer la construction des infrastructures industrielles et scientifiques de base. De ce fait, l'impact de cette émigration s'y manifestera à un triple niveau : celui des institutions de base, des politiques scientifiques et du rapport de la société au savoir.

Au niveau des institutions, l'émigration des scientifiques, par l'ampleur qu'elle prendra à partir de 1986, aura un effet pervers sur l'université et l'entreprise. Elle agira notamment comme élément de déstructuration et d'extraversion pour les institutions scientifiques tout comme elle constituera une entrave au lancement ou à la réalisation de projets de recherche-développement par les entreprises.

A l'échelon plus global de la politique scientifique, le phénomène a contribué à l'émergence d'une logique ou plutôt de logiques internationales tendant à se substituer à la démarche nationale de développement scientifique. Cette mutation s'est accompagnée du retrait de l'État comme acteur principal de la politique scientifique nationale. Cette dernière est en quelque sorte décentralisée par la force des choses au niveau des institutions de base où elle est l'objet de stratégies multiples, et souvent contradictoires.

Mais l'impact le plus fort pourrait être celui qui s'est lancé dans les nouvelles attitudes sociales à l'égard de la science. Ces nouvelles attitudes sont liées à une espèce de désenchantement à l'égard du savoir dont l'émigration scientifique a été le révélateur. Cette dernière est en effet perçue par la société comme le signe, si ce n'est la preuve, de l'échec d'un projet de développement où le savoir est l'élément principal de distinction sociale.

En effet, au lendemain de l'indépendance, et face au nivellement économique et social de la société algérienne par la colonisation, l'accès au savoir apparaissait comme la seule voie du succès en l'absence d'autres formes de différenciation. Ceci se remarquait à travers l'attachement affectif et l'investissement matériel que les algériens ont placé dans l'école. L'accès des enfants à l'éducation était une préoccupation largement répandue. Les pouvoirs publics étaient de ce fait contraints de consacrer régulièrement depuis l'indépendance environ 30 % du budget de l'État à l'éducation.

Aussi un des effets les plus forts de l'émigration scientifique pourrait être la démythification du rôle de l'école, et au-delà du savoir, dans les stratégies de promotion sociale. Pour nombre de gens, le savoir ne s'est pas avéré la bonne clé pour ouvrir les portes du succès puisque dans le meilleur des cas il conduit son détenteur à l'exil.

[1] Selon *Tunis-Hebdo* cité par un quotidien algérien, seul 20 % du total des étudiants tunisiens à l'étranger retournent dans leur pays. Or, le total de ces étudiants était en 1989, selon l'Unesco, de 10 875 contre 16 592 pour l'Algérie.

[2] A cette époque, la médecine était gratuite et son exercice relevait du secteur public. L'ouverture de cabinet de soin privé était autorisé au compte-gouttes.

[3] Ce fut le cas notamment à l'occasion :
- des « Journées d'études sur la formation des cadres en économie de marché », organisées par l'entreprise Enesil le 14 et 15 juillet 1992 à Alger.
- du séminaire national « Université-entreprise : quelles relations », organisé par l'Association pour le développement et la promotion de la science et de la technologie, le 19 et 20 janvier 1993 à Alger.

[4] L'entreprise pétrolière Sonatrach est entrain de rappeler plusieurs années plus tard les boursiers qu'elle a envoyé en formation à l'étranger et qui s'y sont installés, leur demandant en cas de refus de rembourser les frais d'études.

The Return of Students and Researchers

Part 5

Migration of Scientists and Reinsertion Strategies

Pablo Kreimer

Three models of scientific migrations

Roughly, we could establish three different models (as ideal models) of migration of scientists. For the construction of these models we will consider the interaction at three levels of analysis : the micro level of the strategies of the scientists themselves ; the more general level of the devices of an institutional type ; and the macro level of the relationships between the political and scientific research environments. The first model has been very frequent in history and it is the emigration of scientists due to extrascientific reasons, specially as a consequence of political, religious or ethnic conflicts. The first element that we must emphasize in this type of migrations is that it is not a deliberate strategy on the part of the researchers involved, but they are forced to leave the country by reasons that, in many cases, mean a risk for their lives. In the extreme case of the forced exile it is difficult to assess the type of decisions that are taken in this contexts, since in most cases the election of a destination to which to emigrate is made from the assessment of a set of circumstances, among which the specifically scientific strategies are difficult to extricate. As a particularity we can observe that the cases of forced exile have occurred in all types of countries, regardless of the degree of relative development of the country of origin.

This type of migrations are usually long term, since authoritarian regimes are rarely established for very short periods of tie. Thus, a good part of the scientists who have emigrated, are tempted by the host centers to remain for longer periods. As indicated by Gaillard (1994), there is a strong correlation between the acceptance of an employment offer and the number of years of stay abroad. In these situations, the return is usually decided according to two sets of variables : on the one hand, the degree of attachment to local values in the country of origin. Naturally, this assumes a high component of individual behavior, but some macro explanations that may be useful should not be disregarded ; for example, the degree of integration of local society, the existence of strong traditions versus weaker associative models or of great segmentation, etc. The second set of variables is related to the conditions offered by the country for the return. Naturally, the end or weakening of the authoritarian regime is usually considered as an indispensable requirement. But there are also other types of issues that acquire a substantive importance and which we will analyze later on.

As one of the consequences of the case of the migrations forced by authoritarian type regimes, we must point out that there is usually an effect of deep divergence of the so called local scientific community.

On one hand, those scientists that have emigrated usually look with resentment at those who remain in the country, in some cases even considering them accomplices of the relevant authoritarian regime. Secondly, massive emigration of researchers of a specific field of research produces digression in what we have called (Kreimer, 1995) the filiation relations (which constitute the traditions) in scientific research. In view of the absence of a significant portion of scientists of a certain field, or of the dismantling of entire research groups, the following

generations will miss the opportunity to be taught by those teachers and of internalizing, developing or confronting with established traditions. At the same time the scientists that return, in addition to the symbolic capital or credit they earn, shall make important investments in the establishment of new work teams, and of the installation of adequate equipment, in sum, of recreating the conditions that they will judge more adequate for the reinsertion in the environment from which they had been expelled.

On the other hand, those scientists that have stayed in the country during the authoritarian period, in turn, will suddenly see the positions that had been conquered during those years, threatened, specially if the return of researchers from abroad occurs in a significant number. Thus, the morphology of social relations which could have prevailed during a certain period, is abruptly altered, generating segmentations and short circuits in the communications of the local scientific community.

A second model corresponds to long term or permanent scientific migrations which obey to strategic decisions by the researchers themselves. It is essentially different from the previous model, to the extent that these are not compulsive or forced decisions, but the consequence of the assessment of different factors. During a certain time, specially in the 60's, the analysis of this type of migrations, the effects of which were well known under the form of brain drain, was centered on the determinant causes in the expelling country. Without denying the existing conditions of the expelling country, during the subsequent years the problem was started to be considered from a more global point of view. This implied, for the studies carried out towards the end of the 60's and beginning of the 70's, that it was necessary to take into consideration not only the expelling from the country of origin, but also the factors of attraction in the receiving or host country. To this respect, for example, the decision of attracting scientists (or other highly qualified professionals) has formed a part of the explicit strategy of the policy design organizations of some countries.

A substantive difference between the two methods of migration that we analyzed lies in that, while the former may occur in any country in which authoritarian, xenophobic or sectary expressions take place (and very few are exempt from these problems), the latter occurs in a massive manner and under the form of brain drain, in a high correlation, among those scientists from developing countries. Certainly, this does not mean that the researchers from industrialized countries do not emigrate ; however, in general lines, the nature of such migrations is usually different and depends, among other factors, from the degree of development of science and from the strength of the scientific traditions in each country.

We could say that the long term or permanent nature of migrations responds to different patterns. In the case of those countries which already have a scientific tradition, that is, that have the capacity to acquire an initial education in their own country which is then assessed in higher prestige research centers, the own mechanisms of attraction of those centers will play a basic role as a counterweight to the stress, always present that represents the abandonment of a family, institutional and environmental context in the country of origin.

As an important component of the strategies that the scientists can display, we must note the perception that the researcher (potential migrant) has in respect to the prestige of the center in which he wishes to continue working or studying, generally, referred to any of the researches of said center or institution. Regarding this aspect, and important role is also played by the subject on which a researcher wishes to specialize and the importance or the degree of priority given to that subject during the period when the decision to emigrate is taken.

With respect to the conditioners of the local context, the weight of economic factors in the making of decisions by the scientists is undeniable. However, in the decision to extend (even indefinitely) the stay abroad, other kinds of factors usually play a role ; in general, the conditions that a scientist would meet in the case that he would wish to return to his country of ori-

gin. Thus we may think about the type of relations that have been maintained with the initial work group, the consideration in terms of prestige that said group deserves, the institutional structure of his country of origin, the possibility of developing the same work lines in which he works abroad, etc.

In general terms, in the case of countries whose researchers emigrate in a massive way, a study carried out a few years ago recommends to observe attentively the process of formation in a certain country and to analyze whether the number of professionals educated is not in excess of the capacity to offer them work alternative to all of them. According to this same study, this issue is more important that the degree of development of the country itself. It would be in any event necessary to make this proposition relative, to the extent that the excess of professionals can not be considered as an invariable datum, since the dynamics of social institutions (public and private) could (as it has been confirmed in several cases), be pushed just by the abundance of professionals and experiment a development just on this basis.

The third model that we will present is made up by the migrations with a limited duration (in general short or medium term) intended for a specific purpose, generally to pursue a doctor's or postdoctoral degree. Similarly to the preceding model, this one also responds to the types of strategies shown by the scientists in a particular context.

The decision to return to the country of origin, after a period at some foreign laboratory is due, generally, to two types of assessments : on the one hand to the strength of the cultural matrix and to the structure of relations of each researcher in the local context of origin ; on the other hand, to the positive consideration of the work conditions in the institution in which he would work in his own country.

The first set of factors that determine the return of scientists is extremely complex and in order to address it adequately it would be necessary to resort to numerous particular cases, to the extent that each society in particular generates specific mechanisms of integration and identification, as well as of domination and conflict. However, as refers to the structure of relations of a researcher there are important aspects to be considered in the process of return to his country of origin. First, it is necessary to analyze the institutions belonging prior to the departure abroad, the type of institution where he was working, which were his research subjects and which was the institutional place that he, as a scientist, held during that period. Secondly, it is necessary to consider whether, during his stay in the foreign laboratory he kept or not a stable contact with the group of origin. To this respect, in addition to the relations and interests of the researcher himself, it is fundamental to take into account whether the performance of the work or period of studies abroad responded only to his own strategies or also to those of the group of origin. The possibility that the return effectively occurs in the term fixed will greatly grow as both strategies coincide as part of a common interest. Naturally, the possibility that this type of joint strategies occur (migrant researcher - group of reference) depends to a large extent on the degree of consolidation and institutionalization of the group, as well as of the credit/credibility of the head of the local group.

In respect to the latter, it is fundamental to analyze the degree of internationalization of the local group : if the relations with groups abroad who work in related subjects are well developed, it is very probable that the researchers from a developing country choose to carry out work periods abroad (in more developed countries), for a certain period, after which the return to the institution is the most probable outcome. Otherwise, in more isolated groups or researchers with respect to groups from other countries, the strategies of every researcher have more possibilities of being formulated in an individual manner and the return to the country of origin will be less foreseeable.

We are facing here a theoretical problem in the studies of science, such as it is the degree of internationalization of science, versus local characteristics.

Although this is not the place to discuss an aspect of so much importance, we will make at least two remarks. In fact, most of the scientists seem to adhere to the rule of universalism, outlined several decades ago by Merton (1973). Thus, the practice of science as well as its validity seem to be similar, regardless of the country and of the national conditions under which it is developed. However, at least in respect to the developing countries with a certain research tradition, a significant segmentation can be observed between those groups that (for different reasons) are more integrated in the international context and those which seem more isolated to that respect, or more reconcentrated towards the local scientific community. Such segmentation corresponds, to a high degree, to the degree of positive assessment (prestige, visibility, credit) that each group possesses in the local scenario. Thus, while one part of the most integrated groups seem to be convinced that they are developing tasks similar to those of their peers from central countries, the others usually are more conscious about their peripheral condition. The publication differentiated in some determinate journals is usually shown as an example of this type of segmentation.

Although from a first approximation the status of things seems to respond to this perception, by of a more thorough inquiry regarding the practices and beliefs, some issues start to emerge which seriously question the type of integration that such groups effectively achieve at the " international science " level. In this case it would be necessary to remember that more than eighty percent of scientific articles published in the world are written by researchers who are residents of only ten countries. So, even in the case of those groups that perceive themselves as participants of a worldwide system, it is necessary to question oneself regarding this type of integration and whether these groups are really in a condition to " make the same science " as their peers from industrialized countries. Gaillard (1989) appropriately points out that " scientists from developing countries are facing a dilemma : to participate in the solution of local problems or to continue the models and systems of reference more or less imposed by the international scientific community ".

To this respect it could be pointed out that, actually, it does not seem clear either the possibility of engaging in the solution of local problems, to the extent that the financing in most developing countries is usually guided more by the quality patterns of international science (assessment instances by more integrated groups). In addition, the follow up of models of greater attraction in effect in the international scenario, is either not possible (due to multiple restrictions) or is carried out in a position of cooperation many times subordinated. Thus the integration itself to international science acquires many times, characteristics that are more imaginary than real.

With respect to institutional type issues which have an influence on the return of scientists to their country of origin, it is necessary to take into consideration several elements. In the first place, the funding through which the work abroad was performed. A study states that the proportion of scientists returning to their countries of origin is sensibly higher in the cases in which the funding stemmed from a scholarship or special subvention granted by an entity of the country of the researcher or student than in those that were financed with resources from the host country or with his own resources. To this we must add the fact that most of the subsidies are granted under the condition of a commitment signed by the migrant that he will return within a certain time to his country. On the other hand, the existence of institutional mechanisms in the country of origin intended to the repatriation may also play an important role in the process of decision making, such as those that have been put into practice by numerous countries in the last decades, in addition to the various international organizations which have formulated and put into practice programs to aid the return of scientists to their countries.

Most Latin American countries have known, in the last decades, the putting into practice of the three models. At least from the mid 60's, when a period of various military governments is initiated in the Region, a part of the scientists is forced to emigrate. In these cases, the alterna-

tives which were stated to the researchers opposed to authoritarian regimes was the exile, the ostracism or passing on to private institutions where state control was less strict. Most of these forced migrations have had a long term nature, to the extent that, just at the beginning of the 80's, the group of the countries of the Region started to restore the democratic regimes.

Simultaneously with this process, an increasing flow of long term migrations has occurred in Latin America, which corresponds to what we identified as model II : it is the time when the studies on brain drain are started. To give an idea of the magnitude acquired by the migrations during the past decades we can mention as an example that, according to estimates, in the past 25 years the emigration of highly qualified personnel (the information does not discriminate scientists) intended for the United States and Canada was of more than 170 thousand people. The Secretary of Science and Technology of Argentina, in turn, calculated through data obtained in the consulates, in more than 1,700 the amount of scientific researchers residing abroad. The information is relevant if we think that said number is only somewhat lower than the total career researchers belonging to the CONICET, that is, around 2,000. Notwithstanding that, as we already mentioned, in the last few years several mechanisms of encouragement to the repatriation of scientists have been proposed, the total number of Latin American researchers abroad has not significantly decreased. In the case of Argentina, only 15 % of the researchers who reside abroad enrolled in the repatriation program and of them, only one part did in effect return.

Although long term (or permanent) migrations continue to occurr in the Latin American countries, in the last few years it is possible to observe a slow but increasing number of type III migrations ; that is, those responding to the scientists' strategies regarding their education and who later return to the country of origin. Although it is still premature to assume that this is a consolidated tendency and still difficult to give an explanation to it, it is possible to venture some hypothesis.

First, some industrialized countries, the main receivers of Latin American scientists, have established some limitations for the acceptance of foreigners. Secondly, the funding mechanisms put into practice both by the countries of origin and by international organizations and even the receiving countries, are increasingly favoring the stays for a definite period, in general in close relationship with the performance of a research project in the framework of the cooperations, or of doctorate or postdoctorate studies. In general, these mechanisms establish clauses that assume the commitment of return to the country of origin. In the third place, the democratic stability experienced by the majority of countries of the Region operated positively in the sense of educating new generations, not necessarily threatened by persecutions or discriminations of a political type, which were reconstructing, at least in part, some research groups that had been disarticulated in previous decades. As we already mentioned, the possibility of gradually establishing stable mechanisms of intergenerational relation, is an indispensable requirement for the conformation of traditions. In fact, here the differences are well marked between different countries and also along the disciplinary fields.

Strategies for reinsertion of scientists Some reflections from a case study

The study by which we will illustrate some of the problems referred to above was carried out in the laboratories belonging to a Buenos Aires Institute of Molecular Biology and formed a part of a more extensive research study, which included the study of laboratories in France and in England.

The Institute under study was formed as a detachment from one of the most prestigious institutions of Argentina, engaged in biochemical research and founded by somebody who years later would receive the Nobel prize. The founder and current director of the institute, whom we will call L, was one of the privileged disciples of the mentioned Nobel prize.

The first fact that draws one's attention is that L, who is considered a prestigious researcher in the local community, only stayed a very short time (less than one year) working abroad. His entire education took place in the country, most of it under the direction of the mentioned Nobel prize. The reason for this must be found in two types of causes : on the one side, in L's own scientific history, which implied what we could call a disciplinary leap ; from an initial education as doctor (in a time when very few physicians pursued a doctorate), he obtains a doctorate in biology, to pass then to work in biochemical research and later, in a new direction, towards molecular biology. These thematic and disciplinary transitions as part of a strategy usually imply, on the part of the researcher, a special reconversion effort in each one of the directions adopted, specially when they come paired to a strategy that intends to be innovating in the local context. In this case, the researcher establishes a considerable commitment with the development of each one of the research lines proposed, to the extent that they appear, in the local scenario, as moments of rupture with other more established work lines. Along these foundational periods, the departure abroad could imply, from the perspective of the actors, a possibility of loss of space in the local field, since the opening of lines that intend to be innovating necessarily find spaces of conflict with the more traditional sectors. This seemed to have been the case of molecular biology, more evident still for the fact of being a relatively new discipline in the international scenario.

The other set of reasons remit us to the context of science in Argentina about three decades before.

The tradition of biomedical research in the country dates back to the first decades of this century and it is perhaps, one of the areas of greatest visibility in Latin America. At that time, a good part of the education of researchers occurred inside the frontiers and there were only a few scientists that emigrated for short periods to carry out studies or research abroad. We must point out that the institutional financing mechanisms for research just start to become formal in the country in the decade of the 60's, when the CONICET, under the presidency of Houssay, establishes the first scholarship competitions for researchers. Considering both sets of reasons and taking into account that L did not have to suffer directly the attacks of the night of the long canes, which meant the start of the exile of scientists in 1966, it is understood that his development strategy had not included the passing for a certain time at some foreign laboratory.

The institute that we study is divided into 9 laboratories, one of them directly under the direction of L and of the most prestigious researcher (whom we call M), whom he trusts the most and who performs temporarily the direction of the laboratory (L has an important position in the science promotion organization, which takes up most of his time). Of the remaining eight laboratories, seven are managed by researchers of at least one generation after L's : all have pursued their doctorate in the country and at least, one postdoctorate abroad. The heads of each laboratory are also known as " postdoc " of the institute.

Of the seven postdocs, two of them carried it out in England, four in the United States and one in Germany. In addition, two of them worked for more than three years in France, another two were in Switzerland and two in Spain. Most of these postdoctorate studies were carried out about ten years ago. Just as it was possible to anticipate, in the area of molecular biology, the most frequently elected destinations are some countries of Europe (England, France, Germany) and United States. Of the seven, two of them had to emigrate for political reasons since, at the end of the decade of the 70's (the military government took power in 1976) they already worked as researchers or as postgraduate students. The other five decided to pursue their postdoctorate studies abroad as part of a strategic decision. Let's see now with some detail some of the courses taken by them. For an easier presentation we will call them A, B, C, respectively.

The first one of them, A, was working as research assistant towards the end of the 70's, under the direction of his former professors in a project in the biochemical area. Some time after the military coup of 1976, due to its political militancy, he was harassed and had to exile. At that moment L, who already was a member of the faculty with certain prestige and a researcher of the institute which he would later leave, obtained for him the possibility of establishing in a laboratory in New York. Given the prevailing conditions, the process had to be performed in a rush and the laboratory was elected because an Argentinean researcher who was a old friend of L had been working there for some time. It is necessary to point out, since this aspect has had a great importance in the scientific life of the country, the fact that, already in our first interview, L felt necessary to indicate the distance existing, in term of political commitment, between him (and the researcher he trusted) and the other researchers of the institute. According to his own words, "...here all are militants of the left. That is the tradition in Argentina since the 60's. All except M and me ; we are people who belong to the right. However, the people are here to research, and if they are good researchers, I do not care what each one of them may think in political terms. We are very tolerant ".

With the advent of the democratic government, the scientific institutions become normal (throughout the period 1976-1983 they had been intervened by the executive power), L has already separated from the former institute and has founded the current one, dedicated specifically to research in different lines of molecular biology, in general with respect to the mechanisms for the recognition for the detection of trypanosome cruzi (of importance for Argentina because it is the cause of the Chagas disease). L needs to start to form its new institute (in fact, it was still a laboratory), with the incorporation of younger but experienced scientists. A returned to the country a short time after the change of government, moved basically by affection and family ties and without any type of institutionalized support. L finds out that A has returned and has no professional position. Notwithstanding that A's experience in the New York laboratory had been culturing certain cells that did not have any relationship with the research that at the time was being carried out in the laboratory, L proposes to him to join the laboratory, under the condition that he would develop a new research line related to the biotechnological manipulation applied to certain plants. The (implicit) reasons for this offer are two : on the one hand, although the research subjects carried out by A are substantially different from those of interest for the laboratory, the application of the techniques that A had learned in the American laboratory can imply a comparative advantage against other researchers.

On the other hand, because the research in this area appears to be very promising for the interest that some companies would have in funding such projects. From A's perspective, the problem has advantages and inconveniences : on the one hand, it represents to start working with one of the groups that seems to have the greatest possibilities of growth at the time, with the weight of the symbolic load of the tradition of which L declares himself to be the inheritor. But, at the same time, it means to make a significant bet, to the extent that he shall make a rite of passing to a subject of which he ignores almost everything. However, if taking the risk would turn out successful, it would be one of the few to develop such subjects, with the privileges that such a situation would imply. The assessment of the risk, together with the imperative need to avoid being idle do the rest and A joins the institute, where he forms his own group.

In the case of B, the situation is very different. Towards the beginning of the 80's, he was working on his doctorate thesis under the direction of L. Once the thesis was completed, when L was still a researcher of the former institute, they reach an agreement and B leaves also for the university of New York to pursue a postdoctorate. The strategy is stated jointly and without hustle ; the university where the lines that will be of interest for the future of the team is elected, a definite term is established and it becomes evident that, upon his return, B will again form a part of L's research group. The mechanism to finance the trip is also formalized : it is through the application for a foreign scholarship of CONICET. Upon his return, something fun-

damental has changed : L is no longer the head of a group within the institute, but he is the director of a new institute. B should be in conditions to direct one of the subgroups of the institute. But, in order to complete his studies in the detection of a certain type of virus, decides to depart for another period (this time shorter) in a laboratory of France, again with an external scholarship granted by CONICET. When this period ends, then B forms its own group within the laboratory. Another researcher of the institute, C, graduated very young and immediately started to work in an organic chemistry laboratory specialized in enzymology which was an instrumentality of the University. Then he had the opportunity to obtain a postgraduate scholarship in the institute of biochemistry directed by the already mentioned Nobel prize, precisely in L's laboratory. Since he was still working on his thesis in the enzymology laboratory, he had to go to L's laboratory secretly and take advantage of his vacations to perform a series of experiments which he had planned. At that time there had been the coup of 1976 and the situation in the university was very difficult for those who, the same as C, had a firm political militancy since the time he went to high school. For him, as for the majority of the current postdocs, L's laboratory, which was dependent from a private foundation, and with the political tolerance that L himself showed, that laboratory seemed to be a paradise. C consulted it with the directors of his own laboratory and they themselves recommended him to move to L's laboratory if he had the possibility.

Here there is an important meeting point between L and all the younger researchers that we mentioned : the assurance that it was possible to do science in Argentina and it should be done. This conviction crosses through, in fact, the political and even generational gaps that separated these researchers. The origin of the beliefs is different : for L, it results from his belonging to the tradition of the heavy weights of science in Argentina, with whom he worked and studied. Not in vain it had been Houssay who had said the well known sentence that " science had no country, but scientists do ". With respect to the youngest, this belief is generated by the debates that were generated in the country in the 60's, around the commitment by the scientist with his own national reality. This idea of commitment was opposed to the scienticism of those scientists that only worry about the development of their own research subjects, aligned behind the destinies of the " international scientific community ". In the case of those who were young researchers around the 70's, this conviction was framed within the context of an active political militancy in favor of the development of the local capabilities (autonomy) on the subject of scientific and technological knowledge, a requirement to do away with the models of dependency, such as these were perceived. In such a way that, when he has the possibility, after entering L's laboratory, he takes the decision to emigrate, but with a term well established previously. In a course organized in Buenos Aires, C meets another old friend of L who was in charge of a laboratory in Cambridge, England, and decides to go there to pursue his postdoctorate, in a strategy designed by mutual agreement with L, of whom C is already the closest pupil. Upon his return, L had already initiated his own institute, and C returned directly to work in that institution, directing his own group, in a very close cooperation with both L and M. However, C will work in the thematic continuity of what had represented his work in the English laboratory.

In general terms, the other cases of heads of groups have characteristics that combine the three experiences presented by us. So, for example, D turned out to be the son of another scientist well known to L, and upon his return from Germany, which occurred under conditions similar to those of A, creates his own research line. As a general rule, with the exception of A, all the current postdocs have continued working in the same line of their postdoctorate research. This explains, partially, the fact that the institute as a whole keeps close relation and cooperation links with a set of research centers in Europe and United States, each one of them extremely prestigious in the international scenario (such as the center directed by the Nobel prize James Watson, the Pasteur Institute, Cambridge's MRC, among others). Thus, it is possible to understand that L's attraction strategy had coincided, also at this point, with the own strategies shown

by the youngest scientists, to the extent that, for a repatriated researcher it is specially interesting to maintain the same research lines that he had developed abroad, both for the capacity of accumulating knowledge on a certain subject, and to maintain the effectiveness of the established ties. With respect to L, this strategy permits him to cover two objectives at the same time : on the one side, to diversify the research developed in his unit, in the directions that the international scene considers more significant, at the same time showing a set of relations that permit him to " be at the same level " of the centers considered as best in the world.

To this respect, it does not seem to be at chance that the latest generations of young scientists have had as destination for pursuing their postdoctorates almost in their entirety the most prestigious laboratories of the United States. On the other hand, this strategy is fundamental for him in order to obtain a greater visibility in the local society, a greater credibility which will be reconverted, through a process of reinvestment, in a greater credit.

However, this type of reinsertion strategy could not be developed in any framework. If it has been successful, this is due to a couple of additional considerations. First, the fact that the separation of L from the former institute and the foundation of his own institute had coincided, with a difference of a few months, with the restauration of the democratic government, which gave a new impetus to the research and propitiated the return of a significant number of scientists which had emigrated according to model I.

Thus, for example, during the first years of its operation, L's institute suffered for the lack of resources for its financing, purchase of equipment, etc. But the fact of having an important amount of financing intended for the purchase of equipment in the following years was one of the most significant elements and which made possible to a great extent the success of the recruiting strategy. It would have been hardly possible for the postdocs to continue to work on the same research lines if a minimum equipment had not been available making the development of certain lines of work technically feasible.

The public acting by L in the local scientific community and at the levels of scientific management and policy in the country, have played a significant role in this strategy. The fact that towards the end of 1988 the institute had become double dependent, both from the CONICET and from the University of Buenos Aires, was, to some extent, the crystallization of this acting, which occurred while its director was precisely the Dean of the respective school of this University.

What remains to be explained - on the part of the one time young researchers committed to the national reality - is the way to make compatible the increasing internationalization which has oriented their research since the time they have settled again in the country, that is, the development of lines of work which follow the standards of the centers of excellence of the industrialized world, with the ongoing statement of doing a science which is committed to local problems. Certainly, this contradiction is not new for the researchers of the developing countries and it does not seem either that it can be easily solved in the short term.

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Migración de científicos y estrategias de reinserción

Pablo Kreimer

Tres modelos de migraciones científicas

En trazos muy gruesos, podríamos establecer tres modelos diferentes (como tipos ideales) de migración de científicos. Para la construcción de estos modelos habremos de considerar la interacción en tres niveles de análisis : el nivel micro de las estrategias de los propios científicos ; el nivel más general de los dispositivos de tipo institucional ; y el nivel macro de las relaciones entre el ámbito de la política y el de la investigación científica. El primero de los modelos ha sido muy frecuente en la historia, y es la emigración de científicos debida a motivos extracientíficos, en especial como consecuencia de conflictos políticos, religiosos o étnicos. El primer elemento que debemos destacar en este tipo de migraciones es que no se trata de una estrategia deliberada por parte de los investigadores involucrados, sino que se ven forzados abandonar el país obligados por razones que, en muchos casos, significan un peligro para su vida. En el caso extremo del exilio forzado resulta difícil evaluar el tipo de decisiones que se toman en estos contextos, puesto que en la mayor parte de los casos la elección de un destino hacia el cual emigrar se hace a partir de la evaluación de un conjunto de circunstancias, entre las cuales las estrategias específicamente científicas son difíciles de desentrañar. Como particularidad, podemos observar que los casos de exilio forzado se han verificado en todo tipo de países, con independencia del grado de desarrollo relativo del país de origen.

Este tipo de migraciones suelen ser de larga duración, en la medida en que los regímenes autoritarios rara vez se establecen por muy cortos períodos de tiempo. De este modo, una buena parte de los científicos que han emigrado, se ven tentados por los centros huésped para permanecer por más tiempo. Como lo señala Gaillard (1994), existe una fuerte correlación entre la aceptación de una oferta de empleo y el número de años de estancia en el extranjero. En estas situaciones, el retorno suele decidirse de acuerdo con dos conjuntos de variables : por un lado, el grado de apego a valores locales en el país de origen. Naturalmente, esto supone un alto componente de conducta individual, pero no deben descartarse algunas explicaciones macro que pueden ser de utilidad ; por ejemplo, el grado de integración de la sociedad local, la existencia de tradiciones fuertes vs. modelos asociativos más débiles o de gran segmentación, etc. El segundo conjunto de variables se relaciona con las condiciones que ofrece el país para el retorno. Naturalmente, el fin o el resquebrajamiento del régimen autoritario suele considerarse como un requisito sine qua non. Pero hay, además, otro tipo de factores que adquieren una importancia sustantiva, y que analizaremos más adelante.

Como una de las consecuencias del caso de las migraciones forzadas por regímenes de tipo autoritario, debemos señalar que suele producirse un efecto de quiebre profundo de la llamada comunidad científica local.

Por un lado, aquellos científicos que han emigrado suelen mirar con resentimiento a quienes permanecieron en el país, llegando, en algunos casos, a considerarlos cómplices del régimen autoritario en cuestión. En segundo lugar, la emigración masiva de investigadores de un campo específico de investigación produce un quiebre en lo que hemos denominado (Kreimer, 1995)

las relaciones de filiación (constitutivas de las tradiciones) en la investigación científica. Ante la ausencia de una porción significativa de científicos de algún campo determinado, o del desmantelamiento de grupos enteros de investigación, las generaciones siguientes perderán la capacidad de formarse con dichos maestros, y de internalizar, desarrollar o confrontar con tradiciones establecidas. Al mismo tiempo los científicos que retornan, más allá del capital simbólico o del crédito que detenten, deberán realizar importantes inversiones en la constitución de nuevos equipos de trabajo, así como de la instalación de un equipamiento adecuado, en suma, de recrear las condiciones que juzgarán como más aptas para la reinserción en el medio del cual habían sido expulsados.

Por su parte, aquellos científicos que han permanecido en el país durante el período autoritario, verán de pronto amenazadas las posiciones que habían sido conquistadas durante esos años, en especial si el retorno de investigadores del extranjero se produce en un número significativo. Así, la morfología de las relaciones sociales que pudo haber prevalecido durante un período determinado, se ve alterada súbitamente, generando segmentaciones y cortocircuitos en las comunicaciones en la comunidadcientífica local.

Un segundo modelo corresponde a las migraciones científicas de larga duración o permanentes que obedecen a las decisiones de estrategia desplegadas por los propios investigadores. Resulta esencialmente diferente al modelo anterior, en la medida en que no se trata de decisiones de tipo compulsivas u obligadas, sino que son consecuencia de la evaluación de diferentes factores. Durante cierto tiempo, en especial en los años 60, el análisis de este tipo de migraciones, cuyos efectos fueron muy conocido bajo la forma de brain drain o fuga de cerebros, se centró en las causas determinantes en el país expulsor. Sin negar las condiciones presentes en el país expulsor, durante los años siguientes se fue considerando el problema desde una perspectiva más global. Esto último implicó, para los estudios realizados hacia fines de los años sesenta y principios de los setenta, que se debía tomar en cuenta no solo la expulsión del país de origen, sino también los factores de atracción en el país receptor o huésped. En este último sentido, por ejemplo, la decisión de atraer científicos (u otros profesionales altamente calificados) ha formado parte de la estrategia explícita de los organismos de diseño de políticas de algunos países.

Una diferencia sustantiva entre los dos modelos de migraciones que analizamos reside en que, mientras las primeras pueden ocurrir en cualquier país en el cual se desarrollen manifestaciones autoritarias, xenófobas o sectarias (y muy pocos están exentos de estos problemas), las segundas se producen, a nivel masivo y bajo la forma de una fuga de cerebros, en una alta correlación, en aquellos científicos oriundos de los países en desarrollo. Por cierto, esto no significa que los investigadores de los países industrializados no emigren ; sin embargo, en líneas generales, el carácter de dichas migraciones suele ser diferente y depende, entre otros factores, del grado de desarrollo de la ciencia y de la fortaleza de las tradiciones científicas en cada país.

Podríamos decir que el carácter de largo plazo o permanente de las migraciones responden a diferentes matrices. En el caso de aquellos países que ya poseen cierta tradición científica, es decir que tienen la capacidad de adquirir una formación inicial en su propio país que resulta valorada en los centros de investigación de mayor prestigio, serán los propios mecanismos de atracción de esos centros los que jugarán un papel fundamental como contrapeso a la tensión, siempre presente, que representa el abandono de un contexto familiar, institucional y ambiental en el país de origen.

Como un componente importante de las estrategias que los científicos pueden desplegar, debemos notar la percepción que el investigador (migrante potencial) tiene respecto del prestigio del centro en el cual desea continuar trabajando o estudiando, en general referida a la persona de alguno de los investigadores de dicho centro o instituto. En relación con este aspecto, juega también un papel importante el tema en el cual un investigador desea especializarse y la importancia o el grado de prioridad que se le otorga a dicha temática durante el período durante el cual se toma la decisión de emigrar.

Respecto de los condicionantes del contexto local, resulta innegable el peso de los factores económicos en la toma de decisiones por parte de los científicos. Sin embargo, en la decisión de prolongar (aún indefinidamente) la estadía en el extranjero, suelen jugar también otra clase de factores ; en general, las condiciones con las que se encontraría un científico en el caso en que quisiera retornar al país de origen. Así, podemos pensar en el tipo de vínculos que se han mantenido con el grupo de trabajo inicial, la consideración en términos de prestigio que dicho grupo merece, la estructura institucional de su país de origen, la posibilidad de desarrollar las mismas líneas de trabajo en las cuales trabaja en el extranjero, etc.

En líneas generales, en el caso de los países cuyos investigadores emigran de un modo masivo, un estudio realizado hace algunos años recomienda observar atentamente el proceso de formación en un país determinado, y analizar si la cantidad de profesionales que se forman no están en exceso con la capacidad de ofrecerles alternativas de trabajo a todos ellos. Según este mismo estudio, este factor es más importante que el grado de desarrollo del propio país. Sería de todos modos necesario relativizar esta proposición, en la medida en que el exceso de profesionales no puede considerarse como un dato invariante, puesto que la dinámica de las instituciones sociales (públicas y privadas) podrían (como se ha verificado en varios casos) ser empujadas precisamente por la abundancia de profesionales y experimentar un desarrollo precisamente sobre esa base.

El tercer modelo que presentaremos lo constituyen las migraciones de una duración determinada (en general corta o mediana) destinadas a un propósito específico, por lo general realización de doctorados o posdoctorados. De un modo similar al modelo anterior, este modelo responde también al tipo de estrategias desplegadas por los científicos en un contexto particular.

La decisión de retornar al país de origen, luego de un período en algún laboratorio extranjero obedece, en líneas generales, a dos tipos de valoraciones : por un lado, a la fuerza de la matriz cultural y a la estructura de relaciones de cada investigador en el contexto local de origen ; por otro, a la consideración positiva de las condiciones de trabajo en la institución en la cual habrá de trabajar en su propio país.

El primer conjunto de factores que determinan el retorno de los científicos es sumamente complejo, y para abordarlo adecuadamente sería necesario remitirse a numerosos casos particulares, en la medida en que cada sociedad particular va generando mecanismos específicos de integración y de identificación, así como de dominación y de conflicto. Sin embargo, en lo que se refiere a la estructura de relaciones de un investigador hay algunos aspectos importantes para tener en cuenta en el proceso de retorno a su país de origen. En primer lugar se debe analizar la pertenencia institucional previa a la partida al extranjero, el tipo de instituto en el cual estaba trabajando, cuáles eran sus temas de investigación y cuál el lugar institucional que, como científico, ocupaba en ese período. En segundo lugar, es necesario considerar si, durante su estadía en el laboratorio extranjero se mantuvo o no un contacto estable con el grupo de origen. En este sentido, además de las relaciones y los intereses del propio investigador resulta fundamental tomar en cuenta si la realización de un trabajo o período de estudios en el exterior respondió sólo a sus propias estrategias o también a las del grupo de origen. La posibilidad de que el retorno se produzca efectivamente en el plazo fijado crecerá enormemente en la medida en que ambas estrategias coincidan como parte de un interés común. Naturalmente, la posibilidad de que se operen este tipo de estrategias conjuntas (investigador migrante - grupo de referencia) depende en gran medida del grado de consolidación y de institucionalización del grupo, así como del crédito/credibilidad detentado por el jefe del grupo local.

En este último sentido es fundamental analizar el grado de internacionalización del equipo local : si las relaciones con grupos del exterior que trabajan en temas afines están bastante desarrolladas, es muy probable que los investigadores de un país en desarrollo opten por realizar períodos de trabajo en el extranjero (en países más desarrollados), por un período determinado, luego del cual el retorno a la institución es el desenlace más probable. Por el contrario,

en grupos o en investigadores mas aislados respecto de grupos de otros países, las estrategias de cada investigador tienen más posibilidades de formularse de un modo individual, y el retorno al país de origen será menos previsible.

Estamos aquí frente a un problema teórico en los estudios de la ciencia, como es el grado de internacionalización de la ciencia, versus las características locales.

Aunque no es este el lugar para discutir un aspecto de tanta importancia, haremos al menos dos observaciones. En rigor, la mayor parte de los científicos parecen adherir a priori a la norma de universalismo, esbozada hace ya varias décadas por Merton (1973). Así, la práctica de la ciencia tanto como su validez parecen ser similares, más allá del país y de las condiciones nacionales en las cuales se desarrolle. Sin embargo, al menos en lo que respecta a los países en desarrollo con cierta tradición de investigación, se puede apreciar una segmentación significativa entre aquellos grupos que (por diferentes motivos) están más integrados en el contexto internacional, y aquellos que parecen más aislados en ese sentido, o más reconcentrados hacia la comunidad científica local. Dicha segmentación se corresponde, en una alta correlación, con el grado de valoración positiva (prestigio, visibilidad, crédito) que posee cada grupo en la escena local. Así, mientras una parte de los grupos más integrados parecen estar convencidos de que están desarrollando tareas similares a las de sus pares de los países centrales, los otros suelen tener una mayor conciencia acerca de su condición periférica. La publicación diferenciada en algunas revistas determinadas suele exhibirse como una muestra de este tipo de segmentación.

Aunque en una primera aproximación el estado de las cosas parece responder a esa percepción, en una indagación más profunda acerca de las prácticas y de las creencias, van emergiendo algunos matices que ponen seriamente en cuestión el tipo de integración que dichos grupos logran efectivamente en el plano de la « ciencia internacional ». Sería en este caso necesario recordar que más del ochenta por ciento de los artículos científicos publicados en el mundo se concentran en investigadores residentes en sólo diez países. De modo que, aún para el caso de aquellos grupos que se perciben a sí mismos como partícipes de un sistema mundial, es necesario interrogarse acerca del tipo de integración y si, en realidad, estos grupos están en condiciones de « hacer la misma ciencia » que sus pares de países industrializados. Gaillard (1989) señala acertadamente que « los científicos de los países en desarrollo se encuentran confrontados a un dilema : participar en la solución de problemas locales, o seguir los modelos y sistemas de referencia más o menos impuestos por la comunidad científica internacional ».

A esto cabría señalar que, en realidad, tampoco resulta clara la posibilidad de abocarse a la resolución de problemas locales, en la medida en que el financiamiento en la mayoría de los países en desarrollo suele guiarse más bien por los patrones de calidad de la ciencia internacional (instancias de evaluación a cargo de los grupos más integrados). Además, el seguimiento de los modelos de mayor atracción vigentes en la escena internacional, o bien no siempre es posible (debido a múltiples restricciones), o bien se realiza en una posición de colaboración muchas veces subordinada. De modo que la integración misma a la ciencia internacional adquiere, muchas veces, características más imaginarias que reales.

Respecto de las cuestiones de tipo institucional que influyen en el retorno de los científicos a su país de origen, es necesario tomar en cuenta diversos elementos. En primer lugar, el financiamiento a través del cual se realizó el trabajo en el exterior. Un conocido estudio afirma que la proporción de científicos que retornan a sus países es sensiblemente mayor en los casos en que el financiamiento partió de una beca o subvención especial otorgada por un organismo del país del investigador o estudiante que en aquellos que se financiaron con recursos del país huésped o por sus propios fondos. A esto debemos agregar el hecho de que la mayor parte de esos subsidios suelen otorgarse bajo la condición de un compromiso firmado por parte del migrante de que retornará en un tiempo determinado a su país. Por otro lado, la existencia de mecanismos institucionales existentes en el país de origen destinados a la repatriación puede también jugar un papel importante en el proceso de toma de decisiones, tales como los que han

sido puestos en práctica por numerosos países en las últimas décadas, además de diversos organismos internacionales que han formulado y puesto en práctica programas de ayuda al retorno de científicos a sus países.

La mayor parte de los países de América Latina ha conocido, en las últimas décadas, la puesta en práctica de los tres modelos. Al menos desde mediados de los años sesenta, cuando se inicia en la Región un período de diversos gobiernos militares, una parte de los científicos se ven obligados a emigrar. En estos casos, las alternativas que se les planteaban a los investigadores opuestos a los regímenes autoritarios eran el exilio, el ostracismo o el pasaje a instituciones privadas en las cuales el control estatal fuera menos estricto. La mayor parte de estas migraciones forzadas han tenido un carácter de larga duración, en la medida en que, recién a principios de la década del ochenta, el conjunto de los países de la Región va restaurando los regímenes democráticos.

Paralelamente a ese proceso, se ha verificado en América Latina un creciente flujo de migraciones de larga duración, que se corresponden con lo que identificamos como el modelo II : es la época en la cual se ponen en marcha los estudios sobre la fuga de cerebros. Para dar una idea de la magnitud que adquirieron las migraciones durante las últimas décadas podemos citar como ejemplo que, según una estimación, en los últimos 25 años la emigración de personal altamente calificado (la información no discrimina científicos) con destino a Estados Unidos y Canadá fue de más de 170 mil personas. Por su parte, la Secretaría de Ciencia y Tecnología de la Argentina calculó a través de datos obtenidos en los consulados, en más de 1.700 la cantidad de investigadores científicos residentes en el exterior. El dato es relevante si se piensa que ese número es sólo algo menor que el total de investigadores de carrera pertenecientes al CONICET, es decir, alrededor de 2.000. Pese a que, como ya mencionamos, en los últimos años se han propuesto diversos mecanismos de estímulo a la repatriación de científicos, el número total de investigadores latinoamericanos que se encuentran en el exterior no ha disminuido de un modo significativo. En el caso de la Argentina, sólo el 15 % de los investigadores residentes en el extranjero se inscribió en el programa de repatriación, y de ellos, sólo una parte efectivamente regresó.

Si bien las migraciones de larga duración (o permanentes) se siguen produciendo en los países de América Latina, en los últimos años es posible verificar un lento pero creciente aumento de las migraciones de tipo III ; es decir, aquellas que responden a las estrategias de los científicos en cuanto a su formación y posterior regreso al país de origen. Aunque es todavía prematuro suponer que es ésta una tendencia consolidada y difícil aún intentar una explicación para ello, es posible de todos modos aventurar algunas hipótesis. En primer lugar, algunos países industrializados, principales receptores de científicos latinoamericanos, han establecido algunas limitaciones para la aceptación de extranjeros. En segundo lugar, los mecanismos de financiamiento puestos en práctica tanto por los países de origen, como por los organismos internacionales y aún los países receptores, van privilegiando, de un modo creciente, la realización de estadías con una duración determinada, en general en estrecha relación con la realización de un proyecto de investigación en el marco de las colaboraciones, o de estudios de doctorado o posdoctorado. En general, estos mecanismos establecen cláusulas que suponen el compromiso de retorno al país de origen. En tercer lugar, la estabilidad democrática que experimenta la mayor parte de los países de la Región operó positivamente en el sentido de ir formando nuevas generaciones, no necesariamente amenazadas con persecuciones ni discriminaciones de tipo político, que fueran re-construyendo, al menos en parte, algunos grupos de investigación que se habían desarticulado en décadas anteriores. Como ya mencionamos, la posibilidad de ir estableciendo mecanismos estables de relación intergeneracional, es un requisito indispensable para la conformación de tradiciones. Por cierto, aquí las diferencias son muy marcadas entre los diversos países y también a lo largo de los campos disciplinarios.

Estrategias de reinserción de científicos Algunas reflexiones a partir de un estudio de caso

El estudio con el cual ilustraremos algunos de los problemas aludidos más arriba se desarrolló en los laboratorios pertenecientes a un Instituto de biología molecular de Buenos Aires, y formó parte de un trabajo de investigación más amplio, que incluyó el estudio de laboratorios en Francia y en Inglaterra. El Instituto estudiado se formó como un desprendimiento de una de las instituciones más prestigiosas de la Argentina, dedicada a las investigaciones bioquímicas fundada por quien algunos años más tarde recibiría el premio Nobel. El fundador y actual director del instituto fue uno de los discípulos privilegiados del actual director, a quien llamaremos L.

El primer hecho llamativo resulta del hecho de que L, que es considerado un investigador prestigioso en la comunidad local, sólo pasó un muy corto período (menos de un año) trabajando en el exterior. Toda su formación se realizó en el país, la mayor parte de ella bajo la dirección del citado premio Nobel. La razón para esto debe encontrarse en dos tipos de causas : por un lado, en la propia historia científica de L, que implicó lo que podríamos denominar como un salto disciplinar ; de una formación inicial como médico (en una época en la cual muy pocos médicos realizaban una tesis de doctorado), realiza luego su doctorado en biología, para pasar a trabajar más tarde en la investigación bioquímica y luego, en una nueva dirección, hacia la biología molecular. Estos pasajes temáticos y disciplinarios como parte de una estrategia suelen implicar, de parte del investigador, un esfuerzo especial de reconversión en cada una de las direcciones que adoptan, en especial cuando vienen a la par de una estrategia que se pretende innovadora en el contexto local.

En este caso, el investigador establece un compromiso considerable con el desarrollo de cada una de las líneas de investigación propuestas, en la medida en que ellas aparecen, en la escena local, como momentos de ruptura con otras líneas de trabajo más establecidas. A lo largo de estos períodos fudacionales, la partida al extranjero podría implicar, desde la perspectiva de los actores, una posibilidad de pérdida de espacio en el campo local, toda vez que la apertura de líneas que se pretenden innovadoras encuentran necesariamente espacios de conflicto con los sectores más tradicionales. Este pareció haber sido el caso de la biología molecular, más evidente aún por el hecho de tratarsede una disciplina relativamente nueva en la escena internacional.

El otro conjunto de razones nos remiten al contexto de la ciencia en la Argentina unas tres décadas atrás. La tradición de la investigación biomédica en el país se remonta a las primeras décadas de este siglo y es, posiblemente, una de las áreas de mayor visibilidad en América Latina. Por aquellos años, una buena parte de la formación de los investigadores transcurría fronteras adentro, y eran poco numerosos los científicos que emigraban por períodos cortos a realizar estudios o investigaciones en el exterior. Debemos notar que los mecanismos institucionales de financiamiento para la investigación recién comienzan a formalizarse en el país en el transcurso de la década del 60, cuando el CONICET, bajo la presidencia de Houssay, establece los primeros concursos de becas para investigadores. Considerando ambos conjuntos de razones, y teniendo en cuenta que L no tuvo que sufrir directamente los embates de la noche de los bastones largos, que significó el comienzo del exilio de los científicos en 1966, se entiende que su estrategia de desarrollo no hubiera incluido el pasaje por un tiempo determinado en algún laboratorio extranjero.

El Instituto que estudiamos está dividido en 9 laboratorios, uno de ellos directamente a cargo de L y de la investigadora (que llamaremos M) más prestigiosa, en quien tiene más confianza y que ejerce, interinamente, la dirección del laboratorio (L tiene un cargo importante en el organismo de promoción de la ciencia, que le ocupa una parte importante de su tiempo). De los otros ocho laboratorios, siete están a cargo de investigadores de por lo menos una generación siguiente a la de L : todos han realizado su doctorado en el país y, al menos, un posdoctorado en el exterior. Los jefes de cada laboratorio son también conocidos como los « posdoc » del instituto.

De los siete posdoc, dos los realizaron en Inglaterra, cuatro en Estados Unidos y uno en Alemania. Además, dos de ellos trabajaron por más de tres años en Francia, otros dos estuvieron en Suiza y dos en España.

La mayor parte de estos trabajos de postdoctorado fueron realizados hace alrededor de diez años. Tal como era posible prever, en el área de la biología molecular, los lugares de destino más elegidos son algunos países de Europa (Inglaterra, Francia, Alemania) y Estados Unidos. De los siete, dos de ellos debieron emigrar por motivos políticos puesto que, a fines de la década del setenta (el gobierno militar se instaló en 1976) ya trabajaban como investigadores o como estudiantes de posgrado. Los otros cinco decidieron realizar sus postdoctorados en el exterior como parte de una decisión de tipo estratégica. Veamos ahora con cierto detalle algunas de las trayectorias seguidas por ellos. Para mayor comodidad en la exposición los llamaremos respectivamente A, B, C.

El primero de ellos, A, estaba trabajando como ayudante de investigación hacia fines de los años setenta, bajo la dirección de un antiguo profesor suyo en un proyecto en el área bioquímica. Un tiempo después del golpe militar de 1976, debido a su militancia política, fue perseguido y debió exilarse. En ese momento L, que ya era un profesor de la facultad con cierto prestigio e investigador del instituto del cual luego se separaría, le gestionó la posibilidad de establecerse en un laboratorio en Nueva York. Dadas las condiciones que imperaban, la gestión tuvo que realizarse de un modo relámpago y el laboratorio se eligió porque allí había, trabajando hacía algún tiempo, un investigador argentino antiguo amigo de L. Es necesario destacar, puesto que este aspecto ha tenido una gran importancia en la vida científica del país, el hecho de que, ya en nuestra primera entrevista, L se encargó de señalar la distancia que había, en términos de compromiso político, entre él (y la investigadora de su confianza) y los otros investigadores del instituto. Según sus propias palabras...aquí son todos militantes de izquierda. Esa es la tradición en la Argentina desde los años sesenta. Todos, excepto M y yo ; nosotros somos gente más bien derecha.

Sin embargo, aquí la gente está para investigar, y si son buenos investigadores, a mí no me importa lo que piense cada uno en términos políticos. Somos muy tolerantes. Cuando el advenimiento del gobierno democrático, las instituciones científicas se normalizan (durante todo el período 1976-1983 estaban intervenidas por el poder ejecutivo), L ya se ha separado de su anterior Instituto, y ha fundado el actual, dedicado específicamente a la investigación endiferentes líneas de la biología molecular, en general en relación con los mecanismos de reconocimiento para la detección del tripanozoma cruzi (de importancia para la Argentina por ser el causante del mal de Chagas). L necesita ir conformando su naciente instituto (en rigor, se trataba todavía de un laboratorio), con la incorporación de científicos más jóvenes pero experimentados. A volvió al país poco tiempo después del cambio de gobierno movido, fundamentalmente, por los lazos afectivos y familiares y sin ningún tipo de apoyo institucionalizado. L se entera de que A está de retorno y que no tiene ningún lugar en el cual trabajar. Pese a que la experiencia de A en el laboratorio de New York había sido en el cultivo de ciertas células que no guardaban relación con las investigaciones que en ese momento se desarrollaban en el laboratorio, L le propone incorporarse al laboratorio, con la condición de desarrollar una nueva línea de investigación relacionada con la manipulación biotecnológica aplicada a ciertas plantas. Las razones (implícitas) para este ofrecimiento son dos : por un lado, aunque los temas de investigación desarrollados por A sean sustantivamente diferentes de los intereses del laboratorio, la aplicación de las técnicas que A había aprendido en el laboratorio americano pueden implicar una ventaja comparativa respecto de otros investigadores.

Por otro lado, porque la investigación en esa área se presenta como sumamente prometedora en el interés que algunas empresas tendrían en financiar dichos proyectos. Desde la perspectiva de A, el problema tiene ventajas e inconvenientes : por un lado, representa ingresar a trabajar a uno de los grupos que mayores posibilidades de crecimiento parecen tener en esa época,

con el peso de la carga simbólica de la tradición de la cual L se declara heredero. Pero, al mismo tiempo, significa hacer una apuesta significativa, en la medida en que deberá hacer un rito de pasaje hacia una temática de la cual desconoce casi todo. Sin embargo, si la toma de riesgo resultara exitosa, sería uno de los pocos en desarrollar esos temas, con los privilegios que dicha situación implica. La evaluación del riesgo, junto con la necesidad imperiosa de no estar desocupado hacen el resto, y A se incorpora al instituto, en donde forma su propio grupo.

En el caso de B, la situación es muy diferente. Hacia principios de los años ochenta estaba realizando la tesis de doctorado bajo la dirección de L. Una vez terminada la tesis, cuando L todavía era un investigador del antiguo instituto, se ponen de acuerdo, y B parte también a una universidad de Nueva York para realizar un posdoctorado. La estrategia se planea de un modo conjunto y sin apresuramiento ; se elije la universidad en la cual se desarrollen las líneas que serán de interés para el futuro del equipo, se establece una duración determinada, y resulta evidente que, a la vuelta, B volverá a formar parte del grupo de investigación de L. El mecanismo para financiar el viaje también está formalizado : es a través de la solicitud de una beca externa del CONICET. Cuando retorna, algo fundamental ha cambiado : L ya no es el jefe de un grupo dentro del instituto, sino que es el director de un nuevo instituto. B debería estar en condiciones de dirigir uno de los subgrupos del instituto. Pero, para completar su formación en la detección de determinado tipo de virus, decide partir por otro período (esta vez más corto) en un laboratorio de Francia, nuevamente con una beca externa otorgada por el CONICET. Cuando este período finaliza, entonces sí B forma su propio grupo dentro del laboratorio. Otro investigador del Instituto, C, se recibió muy joven y enseguida comenzó a trabajar en un laboratorio de química orgánica especializado en enzimología que dependía de la Universidad. Se le presentó entonces la posibilidad de obtener una beca de posgrado en el instituto de bioquímica dirigido por el premio Nobel que ya mencionamos, precisamente en el laboratorio de L. Como estaba haciendo todavía la tesis en el laboratorio de enzimología, tenía que ir al laboratorio de L a escondidas, y aprovecharunas vacaciones para realizar una serie de experimentos que había planificado. En esa época se había producido el golpe de 1976, y la situación en la universidad era muy difícil para quienes, como C, tenían una firme militancia política desde la época del secundario. Para él, como para la mayoría de los actuales posdoc, el laboratorio de L, que dependía de una fundación privada, y con la tolerancia política que L mismo mostraba, ese laboratorio se parecía a un paraíso. C lo consultó con los directores de su propio laboratorio, y ellos mismos le recomendaron que se mudara al laboratorio de L, si tenía una posibilidad.

Aquí se produce un punto de encuentro importante entre L y todos los investigadores más jóvenes que mencionamos : el convencimiento de que se podía, y se debía hacer ciencia en la Argentina. Esta convicción atraviesa, de hecho, las barreras políticas y aún generacionales que separaban a estos investigadores. El origen de las creencias es diferente : para L, ésta surge de su pertenencia a la tradición de los pesos pesados de la ciencia en la Argentina, con quienes trabajó y se formó. No en vano había sido el mismo Houssay quien había manifestado la conocida frase de que « la ciencia no tiene patria, pero los científicos sí la tienen ». Por el lado, de los más jóvenes, esta creencia viene generada por los debates que se fueron generando desde los años 60 en el país, alrededor del compromiso del científico con su propia realidad nacional. Esta idea de compromiso se contraponía al cientificismo de aquellos científicos que sólo se preocupaban por el desarrollo de sus propios temas de investigación, alineados tras los destinos de la « comunidad científica internacional ». En el caso de quienes eran jóvenes investigadores hacia los años setenta, esta convicción se enmarcaba en el contexto de una activa militancia política en favor del desarrollo de las capacidades locales (autonomía) en materia de conocimiento científico y tecnológico, requisito para romper con los modelos de dependencia, tal como estos eran percibidos.

De modo que, a partir de la experiencia de C (representativa de un movimiento generacional en un sector de los investigadores de la comunidad científica local) vemos cómo, ya en la época

de su formación, existía una tendencia a establecerse en el país para hacer ciencia como parte de un proceso de compromiso explícito que implicaba tomar en cuenta otras dimensiones sociales y políticas. De modo que, cuando se le presenta la posibilidad, luego de haber ingresado al laboratorio de L, toma la decisión de emigrar, pero con un plazo bien establecido a priori. En un curso organizado en Buenos Aires C conoce a otro antiguo amigo de L que estaba a cargo de un laboratorio en Cambridge, Inglaterra, y decide ir allí a realizar su trabajo de posdoctorado, en una estrategia trazada de común acuerdo con L, de quien C ya es el discípulo más cercano. A su vuelta, L ya había iniciado su propio instituto, y C regresó directamente a trabajar en esa institución, dirigiendo su propio grupo, en una colaboración muy estrecha tanto con L como con M. Sin embargo, C habrá de trabajar en la continuidad temática de lo que había constituido su trabajo en el laboratorio inglés.

En líneas generales, los otros casos de jefes de grupo tienen características que combinan elementos de las tres experiencias que presentamos. Así, por ejemplo, D resultaba ser el hijo de otro científico muy conocido por L, y a su vuelta de Alemania, que se produjo en condiciones similares a las de A, funda su propia línea de investigación. Como norma general, con la excepción de A, todos los actuales posdoc han seguido trabajando en la misma línea de su investigación posdoctoral. Esto explica, en parte, el hecho de que el instituto en su conjunto mantiene lazos estrechos de relación y colaboración con un conjunto de centros de investigación en Europa y en Estados Unidos, cada uno de ellos sumamente prestigiosos en la escena internacional (como el centro que dirige el premio Nobel James Watson, el Instituto Pasteur, el MRC de Cambridge, entre otros). Así, es posible entender que la estrategia de captación de L haya coincidido, también en este punto, con las propias estrategias desplegadas por los científicos más jóvenes, en la medida en que, para un investigador repatriado resulta especialmente interesante mantener las mismas líneas de investigación que había desarrollado en el extranjero, tanto por la capacidad de acumular conocimiento en un tema determinado, como para mantener la vigencia de los vínculos establecidos. Por el lado de L, esta estrategia le permite cubrir dos objetivos al mismo tiempo : por un lado, diversificar las investigaciones que se desarrollan en su unidad, en las direcciones que la escena internacional considera como más calientes, al tiempo que despliega un conjunto de relaciones que le permiten « ponerse a la altura » de los centros mejor considerados del mundo.

En este sentido, no parece un azar que las últimas generaciones de científicos jóvenes hayan tenido como destino para la realización de sus posdoctorados casi en su totalidad los laboratorios más prestigiosos de Estados Unidos. Por otro lado, esta estrategia le resulta fundamental para obtener una mayor visibilidad en la sociedad local, una mayor credibilidad que será reconvertida, a través de un proceso de reinversiones, en un mayor crédito.

Sin embargo, este tipo de estrategia de reinserción no podría desarrollarse en cualquier marco. Si ha sido exitosa, esto se debe a un par de consideraciones adicionales. En primer lugar, el hecho de que la separación de L del antiguo instituto y la fundación del propio hubieran coincidido, con unos pocos meses de diferencia, con la restauración del gobierno democrático, que dio un nuevo ímpetu a las investigaciones y propició la vuelta de un número significativo de científicos que habían emigrado según el modelo I.

Así, por ejemplo, durante los primeros años de su funcionamiento, el instituto de L sufrió la carencia de recursos para su financiamiento, la compra de equipos, etc. Pero el hecho de contar con un monto importante de financiamiento destinado a la compra de equipos en los años siguientes fue uno de los elementos más significativos, y que hizo posible en gran medida el éxito de la estrategia de reclutamiento. Hubiera sido difícilmente posible que los posdoc siguieran trabajando en las mismas líneas de investigación de no haber podido contar con un equipamiento mínimo que hiciera técnicamente factible el desarrollo de ciertas líneas de trabajo.

La actuación publica de L en la comunidad científica local, y en las instancias de gestión y de política científica en el país, ha jugado un rol sustantivo en esta estrategia. El hecho de que, hacia

fines de 1988 el instituto obtuviera una doble dependencia, tanto del CONICET como de la Universidad de Buenos Aires, fue, en alguna medida la cristalización de esta actuación, ocurrida mientras su director era precisamente el Decano de la facultad respectiva de esa casa de estudios.

Quedaría por explicar, de parte de los otrora jóvenes comprometidos con la realidad nacional, el modo de compatibilizar la creciente internacionalización que ha orientado sus investigaciones desde que se han reinstalado en el país, es decir, el desarrollo de líneas de trabajo que van siguiendo los cánones de los centros de excelencia del mundo industrializado, con la declaración, aún presente, de hacer una ciencia comprometida con los problemas locales. Ciertamente, esta contradicción no es nueva para los investigadores de los países en desarrollo, y tampoco parece que pueda resolverse fácilmente en el corto plazo.

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The Experience of the PEDECIBA as a Point of Inflection on the Scientific Migrations of the “Basic Sciences” Uruguayan Community

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Introduction

Migrations of highly qualified personnel are well known to have been of utmost importance for the current development of scientific and technological activities in Uruguay. Starting from such assumption this study delves into the case of the community of basic scientists given their particular articulation around the so called ‘Programa de Desarrollo de las Ciencias Básicas’ (Basic Sciences Development Program), henceforth PEDECIBA. We begin our analysis by pointing out some special features of the successive waves of Uruguayan qualified migrants. Then we focus attention on the reasons that, according to the scientists themselves, induced them to return to Uruguay.

The migrations which took place during the seventies and eighties marked the events of the dictatorial regime installed in the country in 1973. Particularly noteworthy are the implications of the new political atmosphere on teaching practices and on the dismantling of the local scientific system in view of the exodus of important contingents of scientists and researchers who left the country to perform their activities in other latitudes.

Once there seemed possible to revert the adverse conditions, and as a fundamental impulse to it, the Uruguayan community of basic scientists undertook the rearticulation of the knowledge generation system through the creation of PEDECIBA. This program emerged in the middle of the eighties as an outcome of the decisive intention to establish and consolidate a stable infrastructure aimed at strengthening an interdisciplinary research system in the following basic sciences : Biology, Chemistry, Information and Computer Science, Mathematics and Physics.

The establishment of the program was an achievement by itself since, still during the period of the authoritarian regime, an increasing number of scientists germinated, and was able to carry on, the union of various ideas and needs. These include : recovering the time lost for scientific activities during more than a decade ; establishing contacts with international organizations in order to obtain support and make the program viable ; giving prominence to graduate education as a means to train human resources - through the creation of the first and only Masters and Doctoral Program in the country - ; reaching a critical mass for research which would make possible the generation of knowledge and the original creation in knowledge frontiers ; and, restoring the exercise of a scientific practice intended to achieve academic excellence in Uruguay. (PEDECIBA, 1985)

It is worth stressing that the establishment of PEDECIBA was a particularly significant event not only because of its being the result of an agreement between the Ministry of Education and

Culture and the Universidad de la República, but also, and mainly, because of the unique structure which it received from the scientists themselves. Such structure included a concern for the university tradition of direct democracy and for the creation of a space that would serve as a nucleus around which both the scientists who had remained in the country during the military dictatorship and those who had settled and were performing their work abroad could join their efforts and place their hopes.

We begin our story here by mentioning some general aspects and providing some data related to the emigration of Latin American scientists which took place during the 70’s and 80’s. Such considerations, we believe, may provide references and a framework to understand the exodus and return of Uruguayan scientists.

We then continue by analyzing what some participants and ‘top personnel’ of PEDECIBA - decision makers and first level researchers [1] - have expressed as their own motivations to return to Uruguay as well as the significance and importance of the program in this process. Basically, we aim at finding answer to two different but related questions : Why and for what purpose to return ? and How and by which means make such return a reality ?

Departures and returns

The analysis of the trends in international migration of Latin American scientists is a current concern for scholars from different fields : demography, sociology and other disciplines. They consider the study of this phenomenon as decisive for what it implies in terms of ‘brain drain’. Consequently they believe it is necessary to frame the question within the current historical trend and to provide a sustainable theoretical approach under which it could be better understood.

The exodus of qualified personnel became a subject of study in Latin American countries many years ago. Adela Pellegrino points out that already in the pioneering studies a reference was made to the amount and importance of the emigration to the United States of America. In a recent study, she also refers to data offered by the Latin American Center of Demography (CELADE) about the percentage variation, occurred between 1970 and 1980, of professionals and technicians of Latin American origin living in that country. In that decade the affluence and variation of Uruguayans in the group of emigrated professionals was very significant and the Uruguayan scientists present the highest rate of increase among professionals coming from neighboring South American countries : 88,3 % - according to absolute numbers obtained from the census of professionals which amounted to 488 in 1970 and to 919 in 1980. (PELLEGRINO, 1993).

At the same time, in most Latin American countries and specially in those traditionally considered as receptors of immigration, there was, in the period 1965-1985, an outstanding increase of migrants from other Latin American countries. Data presented in the research report ‘Professionals and Technicians born in Latin America and the Caribbean living in Latin American countries others from those of birth and in the USA’, show that migration to other countries in the region is larger than the one towards the USA. This data also evidence that, around the 80’s, there was a total of 7220 Uruguayan professionals located in different Latin American countries, emphasizing the enormous affluence towards the bordering ones : Argentina and Brazil. (PELLEGRINO, 1993).

It is also important to recall, when reviewing the migratory phenomenon in macro terms, that South American nations had maintained, to a greater extent than Central American and Caribbean countries, permanent cultural and economic ties with Europe generating another

pole of attraction for scientists. In the case of Argentina and Uruguay, factors that can be faced to the “identifying roots” together with others that emerge from current trends, may have some incidence on the emigration as a whole. The population formation in these countries had its origin in the successive waves of European migrants, basically Spaniards and Italians but also Armenians and Jews among others ; and this background surely influenced the tendency to consider emigration as an actual alternative among a spectrum of possibilities posed not only at the individual level but also at the collective imaginary of these societies.

In the case of Uruguay, and particularly relevant to the scientific community, the development of the educational system created a higher offer of people in better conditions to emigrate. At the same time, this development generated expectations about considering education as a factor of social mobility. However, the inconsistency between the expectations and its viability, the small volume of investments to retain qualified human resources, the economies of scale, and the problems derived from the installed dictatorship, established a significant emigration wave.

In order to estimate the number of Uruguayan professionals coming back from Europe, we will now refer to data provided by the National Repatriation Commission. This entity was created at the governmental level in March 1985 with the purpose to facilitate and support the return to the country of those Uruguayans who wished to do it. The total number of people assisted by the Commission reached 14004 and this figure refers to repatriation of family groups, including teenagers and children. The data is analyzed in the Report on Assisted People produced by the Commission. (COMISION NACIONAL DE REPATRIACION, 1989, ps. 4-6). It provides evidence that the those returning came from the following geographical areas : neighboring countries (26.5 %), other countries of South America (8.5 %), Central America and Mexico (13.0 %), United States and Canada (2.7 %), Europe (41.4 %), Israel (0.6 %), Australia (1.9 %), Asia and Africa (0.4 %), others (5.0 %).

It is important to underline that 75 % of the total number of repatriated people came from the following countries, in Latin America : Argentina (22.0 %), Brazil (4.5 %), Cuba (3.7 %), Mexico (7.5 %) and Venezuela (5.9 %) ; and in Europe : Spain (7.5 %), France (6.8 %) and Sweden (16,8 %). The remaining 10.3 % necessary to attain the 41.4 % mentioned in the preceding paragraph as returning from Europe came from Belgium, Denmark and England. But even more important is to note that, from the total adults assisted by the National Repatriation Commission, 2167 had a university degree before emigrating, 1822 completed their undergraduate studies after leaving the country and 36.5 % of those returning had completed graduate studies while abroad. (COMISION NACIONAL DE REPATRIACION, 1989, Charts No. 10 and 11). It should be pointed out that from those repatriated by the CNR, 3989 were university professionals at the time of returning to the country and at least 2230 had a doctoral degree.

Assuming a considerable margin of error - that the distribution of Uruguayan professionals in the countries indicated above is the same as the one for the total of those assisted by the Commission - it is possible to obtain figures about the number of professionals who lived in other countries and regions, specifically in Mexico (299) and in Europe (1651). Handling a different kind of data, namely, professionals counted as living in some Latin American countries and in USA around 1980 and professionals coming from Mexico and Europe that were estimated between 1985 and 1987 by the CNR, we can arrive to some approximate values. At least 10071 professionals were living abroad having 2230 of them received a doctoral degree. This data is probably under estimated because it does not consider eventual non-returning Uruguayans.

According to Francisco Sagasti and Cecilia Cook, and in order to justify the usual concept of ‘massive exodus’, it is important to note that in 1980 Uruguay had 1500 scientists and engineers engaged in research and development activities (SAGASTI & COOK, 1985, page 20). Even if the 2230 doctors living abroad did not necessarily perform that type of activities, when

they are added up to the other returning professionals (7841) it is possible to realize the importance and quality of the Uruguayan human resources scattered around the world during many years. Many of them did return to the country and the next item will discuss the reasons and expectations for them to do so, as expressed by themselves.

Motivations inducing the return of scientists

As it was shown, many of those who at the time left Uruguay either continued their education through doctorates and post-doctorates or finished their undergraduate courses abroad. In the case of those who, before leaving, were already performing research tasks, they finished their courses and eventually got M. Sc. or specialization’s degrees.

Most of the people that received a full education beyond the countrys’ frontiers fall within one of the specific situations : being too young at the moment of emigration, being deprived of liberty for political reasons (political prisoners) or deliberately and freely choosing to go abroad to begin specific careers not offered by the Uruguayan university system.

The fact is that in one way or another, leaving the country resulted in knowledge enrichment of those who had to do it. Thus, both at the individual level and at the collective level, the Uruguayan scientists who were scattered throughout the world in a sort of national *diáspora*, developed a new scientific vision through shared experience and interrelationship with foreign colleagues. In addition, the insertion in environments or *loci* with different practices and attitudes from the ones current in Uruguay was another factor of major intellectual improvement. This was translated into differentiated subsequent performance and in entering certain research lines or disciplinary approaches that were previously absent.

With the return to democracy there was a renewed concern for science and technology. The thought about the future of the country is renewed and the actors involved orient their interests through paths that must be reconstructed after many years of compulsive interruption. The scientific community was activated as soon as the democratic opening was conjectured. Researchers in different fields joined themselves in their institutions or got closer in a sort of spontaneous affinity that even helped the return of many Uruguayan scientists who were abroad, showing their concern for a country that was left in the margins of the scientific and technological advances achieved in the world.

Within this context, the establishment of PEDECIBA (Development Program in Basic Sciences) highly favored the solidification of the process, not only because it offered conditions for the return but also because it generated the opportunity for the organization of joint activities and projects. In fact, most of the interviewed researchers indicated the importance attached to this project in that sense.

“*I returned after the PEDECIBA was created, because all science was being recreated in Uruguay ; and that helped me to return, thinking that I had to and could collaborate. There was a promise that it was going to be possible to make science. Even international organizations like UNDP and UNESCO were participating in that effort*.”

We found that although in some cases the motivations that induced the return to the country occurred individually, in others they had a collective nature. The latter prevails in the case of academic communities that had been almost fully transplanted to other places. That was the case of the group of Mathematicians who remained anchored in Venezuela. The actors themselves gave an account of the existence of a sort of articulated group that discussed and decided on the options and intentions that could rule not only the individual destiny but also the academic objectives of the group.

“The exile was due to political reasons and lasted the same time that lasted the impossibility to return to the country for political reasons, a little more than ten years. The group of mathematicians was not only a group of friends but also a group who felt that had a mission to fulfill. They saw themselves as the old Institute of Mathematics, (founded years ago by Rafael Laguardia), in exile, and the possibility arose of re-establishing it and to have a common project, not being anymore just a small group. The PEDECIBA project was then immediately discussed and the intention to return and recreate mathematics activities in the country, was adopted.”

The researchers that remained in the country during the previous period, although they did not effectively establish themselves abroad, had a strong connection with what was happening beyond the frontiers. Such connection came, to a large extent, from good relationships between the young researchers, who stayed, and their previous advisors and professors, who fled the country. This appears clearly in the following statement :

“Although I stayed in the country, the presence of my professor abroad meant a sustained support for my work here ; his backing from Mexico was decisive for many of the things I was able to obtain, like traveling abroad and fellowships. Thus even remaining in the country during the dictatorship period I was a recent graduate that had the opportunity to travel and to make several sojourns in France. My situation is that of a scientist that worked in Uruguay under severe isolation but with certain support from people living abroad.”

Returning to the analysis of the motivations for coming back to their country, it is obvious that even finding themselves within better working environments than the one they were going to find in Uruguay, most of them never doubted that they would return as soon as they could. The resolution is a mixture of personal reasons, longing for the roots abandoned by imposition, and always the willingness to contribute to the reconstruction of the scientific activities of the country. As an example, and also as a way to measure the affectionate elements that were always behind the returns, we will refer to what an eminent member of the basic sciences community told us :

“... I know that for many people, coming back was a complex option ; families with grown up children for whom another migration was very complicated ; but for me it was natural. I was waiting for that moment. I was working, gathering information, studying, because I knew that it would be very useful upon returning. On the other hand, in France I was assuming tasks of scientific management that took me away from the laboratory work and this is frustrating. My dream was to go back to Uruguay, to my tiny laboratory, my old lab ; work with two or three young people and be very quiet, coming back to my workbench, working with my hands, being able to do science. I thought about it as something very rewarding. It will be a festivity.... I saw all aspects of the biotechnology challenge and I thought that I could contribute, collectively, to that effort.”

In other cases, the absence of previous traditions in some areas and the existence of a fertile environment for the development of new activities worked as an additional incentive for returning.

“I could have remained abroad but I was always attracted by the idea of coming back because there was space for giving some contribution, and this contribution would be always significant ; in countries with a more developed scientific system you just participate with a small share to something that is already constructed. Here, it was different, everything was still to be done, there was nothing ; only the embryo of something that was being created with the aid of the PEDECIBA project and with the collaboration of other colleagues that were returning. Particularly in my research area, Experimental Physics, there was absolutely nothing and it is always a great challenge to create something, developing science in our own country.”

While abroad fellow countrymen gathered themselves together very often, exchanged informations regarding knowledge generated in each of the disciplines, evaluated needs and possibilities. They developed and shared the idea that all research work that was being done abroad could be carried out in Uruguay and this feeling had a significant incidence on the return of the scientists.

“... Since our first encounter I was struck by the fact that all the people, all of us, were convinced that the work we were doing could be useful for our country. A mathematician, a physician, a chemist a physicist, they all thought ‘this can be done in my country’. The biologist, looking at the revolution taking place in Biology felt the same. We imagined that our country could go ahead and thought that the scientific and technological development would really be the most important instrument.”

The PEDECIBA as an inflection point

Thus, the motivations inducing the return of scientists were mainly related to the contribution that the whole group, sharing a common project, believed they could offer for the rebuilding of the meagre Uruguayan scientific activity. The confluence of hopes expressed individually, together with the collective motivations, gave the setting and the big hopes for those who returned.

The role played by PEDECIBA as the pivot for the members of the basic sciences community was of great importance. The feeling that is was feasible and possible to perform in Uruguay the same activities that were appreciated in other places and that those would result in the common well-being was one of the main driving forces for the return. The confluence of objectives and the harmony between the primary aspirations of the scientists anxious to return and the priorities or guidelines established by the Program show to what extent it became the road for the returns.

Towards the middle of 1984, in the midst of the re-democratization process, and in a climate of uncertainty and hope related to sociopolitical options and economic and cultural reactivating, the scientific community reacted. They proposed themselves to restructure the institution ‘of science’.

There is a rich process of *joint efforts* for the re-establishment of the scientific activity related to basic sciences research and the training of high level human resources. Researchers that at a given moment had chosen (or not) to migrate, decided to return and develop the basic sciences together with those that remained in the country. They brought back not only the pure academic knowledge but the experience of having worked in laboratories of different countries. They also brought back the experience gained with the difficulties resulting from joining the dynamics of each new *locus* and the incorporation of the *scientific ethos* [2] of a foreign community.

These scientists are the ones who, in dialogue with the few that had stayed and promoted the *in situ* actions - through much effort and dealing - make their return effective. It was possible also with the invaluable contribution of some international and national organizations, namely the International Organization for Migrations (OIM), the program implemented by the Comisión Nacional de Repatriación (CNR) and the collaboration of the national University through the Sectorial Commission for Scientific Research (CSIC). These organizations and institutions made possible to bring back a group of important scientists who, together with those who had remained in the country, overtook the task to rebuild the basic sciences in Uruguay. Possibilities, tasks and efforts that were grouped around PEDECIBA with a proposal designed by the scientific community and shaped by their own parameters.

During the dictatorship science was one of the institutions that suffered the most, specially the basic sciences. Thus, repairing this situation was widely felt necessity so that many joint actions were developed. Meetings at different schools, establishing networks, renewing ties, were often proposed in order to try to revert the current situation. At that time the idea of a project for the Development of the Basic Sciences within the UNDP international agency was born out with the aim of organizing postgraduate programs. A logistic and technical support was also

given by ORCYT (Oficina Regional de Ciencia y Tecnología de la UNESCO para América Latina y el Caribe).

It was essentially the self-management spirit of the scientific community, combined with other initiatives, which gave the initial impulse for new actions. Given the evident interest on the part of the scientific community to undertake the tasks that would enable the re-establishment of good level scientific activities, many actions were discussed and designed. During two or three months several meetings were held at UNESCO’s headquarters with the aim to study the viability of the Program. From the first contacts it was clear a manifest disposition on the part of all participants to cooperate in the preparation of a project compatible with the democratization process already in progress.

Beyond the fact that the return of the scientists was an objective by itself, the commited task was of such a magnitude that it could only be undertaken with the cooperation of Uruguayan scientists settled abroad. Thus, it became imperative to establish repatriation mechanisms and to endeavor the return to the country of a good part of them. ‘The selection of these scientists was carried out based on several criteria. These required the scientist : a) to develop scientific activity in universities or equivalent centers ; b) to have an outstanding research production in his/her area of specialization ; c) to be disconnected from groups performing research activities and higher education teaching in Uruguay ; d) to be aware of the difficulties faced by research activities in developing countries and particularly in Uruguay’. (UNDP-UNESCO, 1984, p. 5).

Gradually, and thanks to the economic resources made available by UNDP, it became possible to incorporate to the discussions some of the scientists who, despite being abroad, were in conditions to enter the country again, even if only occasionally. In his study *Científicos uruguayos en el exterior*, Rodolfo Silveira, considering exclusively the scientists members of the ‘basic’ community later grouped around PEDECIBA, gives an account of the return of 133 scientists. (SILVEIRA, 1994, p. 6). They conform a first group that was repatriated and inserted into the university environment in a permanent category. All of them became researchers of the Program and the return was turned effective through an agreement between the National Repatriation Commission and the European Economic Community within the project ‘Return and Reinsertion of Qualified Uruguayans for National Development’. The agreement was intended to facilitate the return and economic reinsertion of near 200 scientists already in the country or still living abroad. There were supposed to have an European experience and qualifications according to the country’s particular interests. (COMMISSION OF THE EUROPEAN COMMUNITIES, 1986). The identification of such specialists was done through the ‘Preparatory Action Plan’. Later on, the PEDECIBA group began to articulate actions with the University of the Republic, some governmental agencies, the Economic European Community (CEE) and the Development Interamerican Bank (DIB) to obtain the funds needed to implement postgraduate programs in basic sciences.

As a corollary we can conclude that the PEDECIBA project succeeded in being the nexus that allowed the unification and consolidation of the Uruguayan basic sciences community, creating the conditions and stimuli for the return of those scientists who where abroad and wishing to return in order to contribute to the establishment and development of a renewed practice.

Concluding remarks

This study aimed to highlight the importance of the scientific migration process for the development of the Uruguayan academic community in the field of basic sciences. Particularly we gave emphasis to the conformation by the same community of PEDECIBA - Program for the

Development of Basic Sciences. This program made possible the return of many exiled scientists. It was around these former emigrants and with the instruments made possible by the Program, that the scientific activities in the country were re-organized and the generation of knowledge and expertise was again in the policy agenda.

It is important to recall that as shown in many interviews there was a common wish, namely, to give the utmost importance of the collective work, to work all together for the re-creation of science as a social institution and for collaborating with the economic, social and cultural development of the country.

The articulations created around PEDECIBA show the permanent effort undertook by a small community and performed in a complex and difficult social situation, to establish a permanent and reliable scientific and technological infrastructure. The Program knew how to interpret and it should also be pointed out that the scientists returned because they saw the possibility that their activities would have a certain acceptance and reception from the rest of the society. Fitting the development of science within the many things that - even today, together with productive reactivation - the country must promote for its *aggiornamento*.

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[1] It should be pointed out that in order to collect the opinions and statements to which we will refer in the course of this article, we interviewed a total of nineteen (19) researchers directly involved with PEDECIBA. The interviews were semi-structured and the scientists selected belong to the different research fields included in the program : 8 Biologists, 3 Chemists, 3 Physicists ; 4 Mathematicians and 1 Information Scientist.

[2] Note that ‘the ethos of science is that affectively toned complex of values and norms which is held to be binding on the man of science. The norms are expressed in the form of prescriptions, proscriptions, preferences and permissions. They are legitimatized in terms of institutional values. These imperatives, transmitted by precept and example and reenforced by sanctions are in varying degrees internalized by the scientist, thus fashioning his scientific conscience or, if one prefers the latter-day phrase, his super-ego. Although the ethos of science has not been codified, it can be inferred from the moral consensus of scientists as expressed in use and wont, in countless writings on the scientific spirit and in moral indignation directed toward contraventions of the ethos’. (MERTON, 1973, p. 269).

La experiencia del PEDECIBA como punto de inflexión en las migraciones científicas de la comunidad “ básica ” uruguaya

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Introducción

En el presente trabajo, partiendo de considerar la trascendencia que las migraciones registradas por la comunidad académica uruguaya tuvo en el devenir de las actividades inherentes al desarrollo científico y tecnológico en el país, nos proponemos ahondar en lo sucedido para el caso específico de la comunidad de cientistas básicos. Dada su particular articulación en torno al así denominado “Programa de Desarrollo de las Ciencias Básicas”, habremos de anotar algunos rasgos característicos de las sucesivas olas de ‘migrantes’calificados uruguayos, para luego centrar nuestra atención en las razones o motivos que, al entender de los propios científicos, les indujeran a retornar al país.

Lo acaecido en el transcurso de las décadas de 1970 y 1980 signaron tanto el devenir del régimen dictatorial que se impuso en el país en el año de 1973 como las implicaciones que el mismo tuvo en la órbita de la práctica académica, incidiendo determinísticamente en el desmantelamiento del sistema científico y en el éxodo de importantes contingentes de cientistas e investigadores que pasaron a desarrollar sus actividades en otros planos y latitudes.

Una vez que las adversas condicionantes vislumbraban revertirse, y como fundamental contribución para ello, la comunidad de científicos básicos uruguayos propendió a la rearticulación del sistema de generación de conocimientos a través de la creación del PEDECIBA. Este emergió, hacia mediados de la década del ‘80, como fruto de la decidida intención de establecer y consolidar una infraestructura estable que objetivara el fortalecimiento de un sistema interdisciplinario en las siguientes ciencias básicas : Biología, Física, Informática, Matemática y Química.

La constitución del Programa fue un logro en sí mismo por cuanto, todavía en tiempos del período de facto, un grupo creciente de científicos germinó, y supo llevar adelante, la unión de diversas ideas y necesidades : recuperar el enorme atraso que más de una década había imprimido al quehacer científico ; establecer contactos con organismos internacionales a efectos de lograr apoyos y viabilizar el proyecto ; priorizar la formación de recursos humanos de nivel de postgrado -mediante la creación e implementación del primer y único Programa de Maestrías y Doctorados en ciencias básicas con que cuenta el país- ; alcanzar una “masa crítica” para investigación que viabilice la generación de conocimientos y la creación original en las fronteras del saber ; y, reinstaurar el ejercicio de una práctica científica tendiente a lograr la excelencia académica en el Uruguay (PEDECIBA, 1985).

Además, es de enfatizarse que la conformación del Programa -amén de que formalmente surgiera por un convenio suscripto entre el Ministerio de Educación y Cultura y la Universidad de la República- reviste la mayor significancia dada la estructura sui generis que los propios cientistas le dieran, por retomar la tónica asociada a la tradición universitaria de democracia directa y por

haber sido el espacio nucleador y en torno al cual unieron sus esfuerzos, y cifraron ilusiones, tanto los científicos que habían permanecido en el Uruguay durante el período correspondiente a la dictadura militar, como quienes se hallaban radicados y desempeñando sus tareas en el exterior.

En una primera instancia, habremos de traer a colación algunos aspectos relativos a la emigración de cientistas latinoamericanos registrada durante los decenios de 1970 y 1980, siendo que dichas consideraciones nos posibilitarán abundar, referenciadamente, en ciertas aristas que conllevaron al éxodo y retorno de los científicos uruguayos en particular.

Habremos de traslucir, a continuación, lo que los propios integrantes de la “plana mayor” del PEDECIBA -decisores actuantes en la órbita del diseño de políticas e investigadores de primer nivel [1]- entienden como las motivaciones que les indujeron a regresar al Uruguay ; así como revelaremos la importancia que le cupo al Programa en tanto “instrumento” cristalizador del proceso. Reduciendolo a dos interrogantes de distinto tenor : ¿por qué y para qué regresar a la comunidad científica de orígen ? ; y ¿cómo, o a partir de qué, efectivizar dicho retorno ?.

Idas y regresos

El analizar las tendencias de la migración internacional registrada entre los cientistas latinoamericanos ha sido motivo de preocupación por parte de quienes -desde el campo de la Demografía, la Sociología u otras disciplinas- entienden el fenómeno como decisivo, tanto por lo que el mismo implica en términos del “drenaje de talentos” como por la necesidad de enmarcarle en la coyuntura histórica determinante y en el plano de las aproximaciones teóricas al problema.

Así, el tema del éxodo de personal calificado se volvió motivo de estudio en los países de América Latina ; y ello ocurrió desde muy temprano. Adela Pellegrino señala que ya a partir de los trabajos pioneros se alude a la cuantía e importancia de la emigración hacia Estados Unidos de Norteamérica y, en un trabajo reciente, la autora refiere a datos ofrecidos por el Centro Latinoamericano de Demografía acerca de la variación porcentual, registrada entre 1970 y 1980, de profesionales y técnicos de origen latinoamericano residentes en dicho país. En esa década la afluencia y variación de uruguayos en el conjunto es la que aduce la mayor variación porcentual : 88,3 % -según números absolutos de profesionales censados que remiten a 488 en 1970, y 919 en 1980 (PELLEGRINO, 1993).

Por su vez, en la mayoría de los países latinoamericanos, y en especial en los tradicionalmente considerados receptores de inmigración, se verifica, en el lapso 1965-1985, un notable incremento de los originarios de otros países latinoamericanos ; incluso al punto de que la emigración hacia países de la región es mayor que la que se dirige hacia los Estados Unidos. Según datos sobre “Profesionales y técnicos nacidos en el Uruguay y censados en países de América Latina y el Caribe” alrededor de los años ‘80, hallamos que un total de 7220 personas con tales cualificaciones fueron censadas en distintos países ; debiéndose destacar la enorme afluencia hacia los países limítrofes : Argentina y Brasil (PELLEGRINO, 1993).

También es de tenerse en cuenta, al revisar el fenómeno migratorio en términos macro, que el hecho de que las naciones de América del Sur hayan mantenido, en mayor medida que las de América Central y el Caribe, vinculaciones culturales y económicas con Europa ha generado una cierta diversificación en la orientación de los flujos de científicos hacia ese destino. En el caso de Argentina y Uruguay diversos factores que provienen incluso de las ‘raíces identificatorias’, aunados a elementos coyunturales, llegan a tener cierta incidencia ante el fenómeno de la emigración. En esta línea argumental, la conformación poblacional por sucesivas oleadas de migrantes europeos -fundamentalmente españoles e italianos pero también armenios y judíos-

influye en una tendencia a considerar la migración como una alternativa real dentro del espectro de posibilidades que se plantean, tanto a nivel individual como en el imaginario colectivo de estas sociedades.

En el caso uruguayo, y aún permeando la comunidad científica, el desarrollo del sistema educativo creó una oferta mayor de personas que podían optar por emigrar; a la vez que, históricamente, generó expectativas respecto de la educación como factor de movilidad social. La inconsistencia entre las expectativas creadas y las oportunidades para su viabilización, las escasas posibilidades y mayores dificultades para retener recursos calificados -por el pequeño volumen de las inversiones, por las dimensiones de los proyectos, por las economías de escala y por otros factores-, aunados a los problemas devenidos de la instauración de la dictadura, confluyen en la oleada emigrante de la que dabamos cuenta.

Considerando ya los retornos devenidos, y en pos de aproximarnos a los datos que refieren a quienes luego retornaron de países ubicados en el continente europeo, entendemos pertinente remitir a la información brindada por la Comisión Nacional de Repatriación, organismo creado a nivel gubernamental, en marzo de 1985, con el cometido de facilitar y apoyar el regreso al país de todos aquellos uruguayos que desearan hacerlo. El total de asistidos por dicha Comisión, tal como consta en su “Informe sobre asistidos” (COM. NAC. DE REPATRIACION, 1989, págs. 4-6), alcanzó a las 14.004 personas -cifra que, por tratarse de repatriación de núcleos familiares, incluye también niños y adolescentes- con una dispersión de retornantes centrada en las siguientes áreas geográficas : Países Limítrofes (26,5 %), Resto de América del Sur (8,5 %), América Central y México (13,0 %), EE. UU y Canadá (2,7 %), Europa (41,4 %), Israel (0,6 %), Australia (1,9 %), Asia y Africa (0,4 %), otras (5,0 %).

Resulta importante, a nuestros efectos, resaltar que el informe mencionado reconoce ocho países de los cuales provino el 75 % del total de repatriados; ellos son, en la órbita de Latinoamérica : Argentina (22,0 %), Brasil (4,5 %), Cuba (3,7 %), México (7,5 %) y Venezuela (5,9 %), y en la órbita europea : España (7,5 %), Francia (6,8 %) y Suecia (16,8 %). Así, hallamos que de este sub-grupo de países europeos mencionados provino el 31,1 % de los repatriados de aquel continente, integrándose el 10,3 % restante -tomando en cuenta el total de 41,4 % aducido hacia el final del párrafo anterior- con quienes procedían de Bélgica, Dinamarca e Inglaterra. Pero más importante aún es el anotar que, del total de adultos asistidos por la Comisión Nacional de Repatriación, 2.167 tenían formación universitaria completa antes de emigrar, 1.822 finalizaron sus estudios de grado luego de haberse marchado del país y un 36,5 % de los retornantes habían completado sus estudios de Doctorado estando en el exterior (COM. NAC. DE REPATRIACION, 1989, Cuadros Nros. 10 y 11). Vale decir que, de entre quienes fueron repatriados a través de la CNR, 3.989 personas eran profesionales universitarios al momento de retornar al país, y al menos 2.230 de ellos eran Doctores -pudiéndose ampliar este guarismo si contáramos con información respecto a quienes ya habían alcanzado este nivel antes de emigrar; integrantes de la comunidad científica que hubieran cursado sus Doctorados en el exterior, hacia las décadas del ‘60 y ‘70, previo a su posterior exilio-.

Asumiendo un margen de error considerable, a partir del suponer que la distribución de profesionales en los países señalados fuera acorde a la misma para el total de asistidos, podríamos inferir datos acerca de los profesionales que se encontraban en un otro país latinoamericano -México, con 299 de ellos- y en el continente europeo -globalmente, 1651-.

Así, tomando datos de dos tenores diferentes -profesionales censados, hacia 1980, en ciertos países de América Latina y en Estados Unidos, por un lado; y profesionales provenientes de México y Europa, estimados según información de los retornados vía la Comisión Nacional de Repatriación entre 1985 y 1987 (cifra sub-valuada por cuando en dichos países podían haber más profesionales, eventuales no-retornantes)- encontramos que los guarismos darían cuenta de un total de 10.071 profesionales que se encontraban fuera del Uruguay; y de los cuales sabemos que un mínimo de 2.230 tenían formación Doctoral en ocasión de su regreso.

A efectos de dar propiedad al “éxodo masivo” al cual se acostumbra hacer referencia, gustaríamos de traer a colación el que -según datos manejados por Francisco Sagasti y Cecilia Cook- en el año 1980 el Uruguay contaba con 1.500 científicos e ingenieros dedicados a actividades de investigación y desarrollo en el país (SAGASTI & COOK, 1985, pág. 20). Tal vez los 2.230 Doctores que estaban fuera de fronteras no necesariamente desarrollaran actividades de ese tipo, pero de todas formas nos dan cuenta -y ello, abrumadoramente, al tomar los otros 7.841 profesionales- de la trascendencia y valía de los recursos humanos que el Uruguay tenía dispersos por el mundo entero. Buena parte de los mismos regresó al país y a continuación habremos de referirnos a las razones susceptibles de hallarse por trás de dichos retornos, en opinión de los propios científicos e investigadores.

Motivaciones inductoras del retorno de los científicos

En primera instancia, resulta insoslayable el resaltar que quienes en su momento se marcharon del Uruguay bien continuaron con su propia formación, a través de la realización de Doctorados y Post-Doctorados -e incluso, en el caso de quienes antes de irse desarrollaban incipientes labores de investigación, culminando los cursos eventualmente incompletos y realizando Maestrías o Programas de Especialización-, bien se formaron íntegramente fuera de fronteras -por ser lo suficientemente jóvenes cuando se fueron como para no haber culminado sus graduaciones, por haber sido prisioneros políticos imposibilitados de seguir con su formación durante ciertos años, o por haber optado por determinadas orientaciones que el sistema universitario uruguayo no estaba en condiciones de ofrecer.

Lo cierto es que, de una forma u otra, el irse del país redundó en el enriquecimiento de quienes debieron hacerlo -por motivos de índole político, por haber alcanzado el “techo” académico o a partir de motivaciones académicas y oportunidades surgidas-. Es así que, tanto en el plano individual como a nivel colectivo, los cientistas uruguayos que se hallaban desperdigados por el mundo -en una suerte de “diáspora” nacional- fortalecen, a través de las experiencias colectadas, y actualizan, vía la interrelación con sus colegas en el extranjero, la visión científica otrora percibida. Por su vez, la inserción en ámbitos o locus sustentadores de una práctica diferente a la internalizada en el Uruguay fué otro factor de enriquecimiento mayúsculo, el cual se tradujo en un diferenciado desempeño posterior y en el incursionar en determinadas líneas de investigación u abordajes disciplinarios anteriormente ausentes.

Con el retorno a la democracia se asiste a un renacimiento de las preocupaciones por la ciencia y la tecnología ; siendo que las problemáticas jerarquizadas, al renovarse el pensamiento sobre el futuro del país, buscan canalizar sus inquietudes por cauces que deben reconstruirse luego de tantos años de compulsiva interrupción. La comunidad científica se activa tan pronto se insinúa la apertura democrática y, en los diversos campos, los actores se nuclean en el marco de sus instituciones o se aproximan por una suerte de afinidad espontánea que incluso lleva a que muchos de los científicos uruguayos que se encontraban en el exterior vuelvan, mostrando su inquietud por un país que supo quedar al margen del avance científico y tecnológico dado en el mundo.

En este contexto, el surgimiento del PEDECIBA coadyuvó a la concresión del proceso, tanto por el favorecimiento en términos de condiciones para el regreso como por haber generado una instancia nucleadora de actividades y proyectos. De hecho, la mayoría de los investigadores entrevistados a efectos de la elaboración de este trabajo señalan la importancia que la conformación del Programa tuvo en este sentido :
“Yo volví luego de haber surgido el PEDECIBA, porque acá estaba como recreándose toda la ciencia y ello impulsaba a volver ; pensando en que había de contribuir para el desarrollo de la ciencia en el Uruguay. El regreso se dio en ese marco, y ése era un marco para desarrollar

la ciencia acá. Había una promesa de que se iba a poder hacer ciencia, había un esfuerzo incluso internacional -por la participación del PNUD y UNESCO- apuntando a ello".

Asimismo, encontramos que si bien en algunos casos las motivaciones que indujeron a retornar al país se dieron a un nivel individual, en otros las mismas tuvieron una impronta de colectivo. Esta última característica prima en los casos de comunidades que previamente se habían cuasi que transplantado del Uruguay hacia otro lugar de destino -y cuya ejemplificación resulta clara en el caso de los Matemáticos, ubicados mayoritariamente en Venezuela-. Ante tales experiencias, los propios actores dan cuenta de la existencia de una suerte de grupo articulado y en el seno del cual se barajaban las opciones e intenciones que habían de rumbear no sólo los destinos individuales sino también el disciplinar común :
"El exilio fue por razones políticas y duró lo que la imposibilidad de volver por razones políticas al país, algo más de diez años... (siendo que) el grupo matemático no sólo era un grupo de amigos, sino también un grupo que sentía tenía una misión ; y que se veía a sí mismo como el Instituto de Matemática fundado por Rafael Laguardia, en el exilio. Se sentía que se iba a reconstruir eso y algo importante es que, en particular entre los Matemáticos que tenían una tradición de pequeño grupo que venía de muy atrás, había un proyecto en común. Todo el tema del PEDECIBA fue discutido inmediatamente, y había todo un proyecto y una intención común de vuelta, para reconstruir la actividad matemática en el país."

Coexistiendo la vuelta a una forma de vida democrática en el país con el impulso del PEDECIBA y con el retorno de gente, hallamos que aquellos investigadores que habían permanecido en el Uruguay durante el período precedente si bien no se dislocaron de forma efectiva al exterior, puede decirse que sí mantuvieron una fluída conexión con lo que acaecía fuera de fronteras. Dicho vínculo provenía, en buena medida, del relacionamiento que los jóvenes investigadores que estaban en el país sostenían con quienes habían sido sus profesores u orientadores, que se hallaban fuera ; tal cual se trasluce en lo manifestado al respecto :
"Si bien yo me quedé en el Uruguay, la presencia de mi profesor fuera se volvió un apoyo sostenido para lo que fue mi trabajo acá... su apoyo desde México resultó decisivo para muchas de las cosas que yo pude hacer -en especial viajar, conseguir becas, salir del país-. Así, si bien yo estuve aquí en la época de la dictadura, tuve la suerte de ser un recién graduado al que se le presentaron oportunidades de viajar bastante e hice estadías largas en Francia. Mi situación es la de un científico que trabajó en el Uruguay en condiciones de extremísimo aislamiento, pero con un cierto apoyo de gente que estaba afuera."

Pero acotándonos a las motivaciones que indujeron a quienes se encontraban en el exterior para volver, hallamos que un cúmulo considerable de los investigadores entrevistados sostuvo que para ellos volver al Uruguay sabían, ya desde antes, había de ser la opción a adoptar. Vale decir que, aún encontrándose insertos en ambientes de trabajo que les ofrecían muchas mejores condiciones que aquellas de las cuales habían de disponer una vez retornados, en algunos casos nunca habían dudado de que habían de volver apenas pudieran hacerlo. Los motivos sustentadores de tal visión entremezclan razones de índole personal, anhelo por reencontrarse con las raíces dejadas por imposición y, siempre, la voluntad de emprender el regreso como forma de contribuir al devenir científico del país. A modo de ejemplo, e incluso también como forma de calibrar los elementos entrañables que se ubican detrás de los retornos, habremos de referir a lo que un eminente miembro de la comunidad científica básica nos dio cuenta :
"... Para muchos yo sé que fue una opción compleja ; había personas que tenían familias con hijos grandes y para las cuales nuevos transplantes se volvían complicados, pero para mí era como natural. Yo estaba esperando ese momento. Estaba trabajando, juntando papeles y estudiando porque pensaba que todo eso, algún día, podía servir acá. Por otra parte, en Francia yo ya estaba asumiendo tareas de gestión científica que me alejaban de la mesada de trabajo del laboratorio, y eso para un científico es frustrante. Mi ilusión era pensar que iba a volver al Uruguay, y que iba a tener un laboratorio chiquitito -mi viejo laboratorio- en el cual trabajar con

dos o tres jóvenes y estar muy tranquilo ; volviendo a la mesada, trabajando con mis manos, pudiendo hacer ciencia. Lo pensé como algo muy especial. Para mí iba a ser una fiesta.... Veía todos los aspectos del desafío biotecnológico y pensaba en contribuir, colectivamente, en un esfuerzo en ese sentido.”

En otros casos, la ausencia de tradiciones previas en ciertas áreas se veía como un aliciente adicional ; entendiéndose, por parte de algunos, que el hecho de que se contara con un campo fértil para el desarrollo de las actividades acentuaba los incentivos al retorno :
“En realidad, yo pude haberme quedado en el exterior pero siempre me atrajo la posibilidad de venir ya que acá había un campo prácticamente libre y en el cual cualquier contribución que uno pudiera venir a dar iba a ser una contribución significativa ; contrario a lo que pasa en otros países, cuando uno llega a poner su granito de arena en una montaña que ya está construída. Acá era distinto. Hacia mediados de los ‘80 acá había realmente muy poco ; en el país no había nada y estaba sólo el embrión que se estaba gestando a través del proyecto PEDECIBA, justamente con otros colegas que estaban regresando. En particular, en mi tema (Física Experimental) no había absolutamente nada y siempre es un gran desafío pensar en la posibilidad de crear algo en un terreno vírgen, pensar en hacer surgir un área que no existe y desarrollar una ciencia en tu propio país.”

Además, otro factor que fué de la mayor incidencia para el regreso de los cientistas se relaciona al sentir generalizado, que tenían estando fuera, respecto a que todo lo que se desarrollaba en otras latitudes -y según cada quien, en el país o región específica en que se hallaba- podía también ser llevado a cabo en el Uruguay. Estando en el exterior los compatriotas se reúnen, comentan acerca de las labores que llevan adelante, intercambian informaciones respecto al conocimiento generado en cada una de sus especialidades y coinciden en que todo ello podría realizarse también en el país :
“... Porque desde el primer contacto que tenemos lo que más me llama la atención es que las otras personas, todos nosotros, pensábamos que lo que estábamos haciendo le podía servir al país. Que un Matemático dijera ‘mirá que esto se puede hacer’; que lo dijera un Médico, un Físico, un Químico... Se estaba viniendo toda la revolución en Biología y pensaba que eso podía aportarse, y que podía hacerse en Uruguay. Todos pensabamos que los montones de cosas que se estaban viendo en el mundo también podían hacerse en el Uruguay. Veíamos que un país como el nuestro podría salir adelante, y que el desarrollo científico y tecnológico podría, realmente, ser un puntal para que el país saliera adelante.”

El Pedeciba como punto de inflexión

Es así que las motivaciones inductoras del regreso de los científicos hilvanan ideas que refieren a la importancia de contribuir, entre todos, para el renacimiento de la ciencia. Ideas que, paulatinamente, se asientan en torno a la reconocida necesidad de encarar un proyecto común que posibilitara reconstruir la otrora tan menguada actividad científica, siendo que la confluencia de voluntades, expresadas de manera individual, se auna a las motivaciones colectivas y a las esperanzas cifradas por los retornantes en este sentido.

El papel desempeñado por el PEDECIBA en tanto nucleador de los integrantes de la comunidad científica básica uruguaya, es ponderado como un facilitador de destacadísima trascendencia. Sentir que en el Uruguay sería factible -y habría de poderse- hacer lo que ellos apreciaban se realizaba en otros contextos, y pensar que el abocarse a tales tareas había de redundar en el bien común, también son factores revelados como de primer orden entre las razones inductoras al regreso. La máxima confluencia de cometidos y la sintonía dada entre

aquellos aspectos que los cientistas ansiosos de regresar revelan como primordiales, y las priorizaciones o lineas orientadoras establecidas al interior del Programa dan cuenta de cuánto éste llegó a constituirse en el instrumento efectivizador de los retornos que nos ocupan.

A partir de la reapertura que se vivía en el Uruguay hacia mediados de 1984 -y en medio de un clima de incertidumbre y esperanza relacionado con las futuras opciones socio-políticas, y las posibilidades de una reactivación económica y cultural- la comunidad científica se plantea el pensar la reestructuración de la ‘institución ciencia’en el país.

Habiéndose registrado el éxodo masivo de cientistas al que hacíamos referencia, durante el régimen de facto que se vivió en el país a partir de 1973, se da -en los prolegómenos de la reinstauración democrática e impulsado por un cierto grupo de ellos- un muy rico proceso de “aunar voluntades” para la re-implantación de la actividad científica relativa a investigación básica y formación de recursos humanos de alto nivel en el Uruguay. Investigadores que en un momento dado habían optado (o no) por marcharse -con todo lo que ello conlleva en relación a : acumular experiencia en laboratorios de diferentes países, incorporarse a las dinámicas de cada nuevo locus y acoplarse al ethos científico [2] imperante en la comunidad de destino- deciden, por los motivos ya revisados, regresar a desarrollar las ciencias básicas junto a quienes habían permanecido en el país.

Son esos cientistas, en diálogo con los pocos que se habían quedado e impulsaban las acciones in situ, quienes -esfuerzos y tratativas mediante- efectivizan su regreso a partir, muy especialmente, de la contribución brindada por determinados organismos internacionales ; en particular : la Organización Internacional para las Migraciones (OIM), el programa implementado especialmente por la Comisión Nacional de Repatriación del que ya dimos cuenta y la ayuda otorgada en la órbita universitaria -básicamente a través de la actual Comisión Sectorial de Investigación Científica (CSIC)-. Tales organismos e instituciones posibilitaron el traer de vuelta a un cúmulo importante de científicos que, junto a los que habían permanecido en el país, emprendieron la tarea de « reflotar » a las ciencias básicas en el Uruguay. Posibilidades, tareas y esfuerzos que se nuclean alrededor del PEDECIBA ; a partir de una propuesta nacida en el seno de la comunidad científica, y que contiene conceptos originados en ese ámbito.

Por otra parte, durante la dictadura una de las instituciones que más sufrió en el Uruguay fue la ciencia -y muy especialmente la ciencia básica- ; compartiéndose luego un sentir general sobre la necesidad de recuperarla. A partir de tales intenciones, algunos de los científicos que se encontraban en el país comienzan a unir esfuerzos, marcar reuniones en diversas Facultades, tender redes, retomar contactos y estrechar lazos en aras de intentar cursos de acción que posibilitaran -a mediano o corto plazo- revertir en algo la situación planteada. Es en este clima que nace, en el seno del Programa de las Naciones Unidas para el Desarrollo, el propósito de iniciar e instrumentar un proyecto de desarrollo de las Ciencias Básicas en el Uruguay, con énfasis en el otorgamiento de títulos de postgrado. Esta idea se vigoriza luego con el apoyo logístico y técnico brindado por la Oficina Regional de Ciencia y Tecnología de la UNESCO para América Latina y el Caribe (ORCYT).

Fue, esencialmente, así que surgió la idea de reflotar la actividad científica en el país : a partir del espíritu auto-gestionario de la comunidad científica ; y contándose con diversas iniciativas que se aunaron al impulso dado por los propios cientistas. A partir del manifiesto interés de la comunidad científica por emprender y agilitar las gestiones que posibilitaran la reimplantación de actividades de buen nivel en el país, se sucedieron una serie de reuniones -durante dos o tres meses, encuentros que tuvieron lugar en la residencia de la UNESCO- tendientes a estudiar la viabilidad del Programa. A partir de los primeros contactos se puso de manifiesto la explícita voluntad de todos los participantes en contribuir a la elaboración de un proyecto compatible con el proceso de democratización que ya se insinuaba en el país ; habiendo también un claro consenso en considerar a las ciencias básicas como factores imprescindibles en la necesaria reestructuración técnico-cultural y educativa.

Amén de ello -y más allá de que el favorecer el retorno de los científicos fuera un objetivo en sí mismo- se entiende que una tarea de tal magnitud debería ser emprendida no sólo por miembros de la comunidad científica local. Así, se vuelve perentorio contar también con la colaboración de los científicos uruguayos radicados en el exterior, lo cual implicaba la creación de mecanismos de repatriación y el bregar porque buena parte de los mismos retornara al país. “La selección de estos científicos se realizó basandose en las siguientes condiciones : a) mantener actividad científica en centros universitarios o equivalentes ; b) poseer una producción de nivel destacado en el área de especialización ; c) estar en la actualidad desvinculados de los grupos que desarrollan tareas de investigación y docencia superior en el Uruguay ; d) conocer las dificultades que enfrenta la investigación en los países en vías de desarrollo, y particularmente en el Uruguay.” (PNUD-UNESCO, 1984, pág. 5)

Paulatinamente, y gracias a los recursos que puso en disponibilidad el PNUD, fue posible incorporar a las discusiones a algunos de los cientistas uruguayos que se encontraban fuera del país y en condiciones de ingresar, aunque más no fuera circunstancialmente, al mismo. Acotando su análisis a los científicos integrantes de la comunidad ‘básica´ que posteriormente se nucleara en torno al PEDECIBA, Silveira da cuenta del retorno -en una primera etapa- de 133 científicos básicos repatriados e insertos en el ámbito universitario de manera estable. (SILVEIRA, 1994, pág.6). Todos ellos se tornaron investigadores del Programa ; siendo que los mismos efectivizaron su regreso a partir de un convenio específico suscripto por la Comisión Nacional de Repatriación y la Comunidad Económica Europea (CEE) a efectos de financiar un proyecto relativo al “Retorno y reinserción de uruguayos calificados para fines de desarrollo nacional”. A través de éste se proponía facilitar el retorno y la reinserción socio-económica de más o menos 200 científicos uruguayos que ya hubieran regresado o estuvieran viviendo aún en el extranjero, especialmente en Europa, y que poseyeran cualificaciones de particular interés para el país. (Commission of the European Communities, 1986). La identificación de tales especialistas había de darse en el marco de un “Programa de Acción Preparatoria” ; siendo que posteriormente, y avanzando hacia su establecimiento y viabilización, el PEDECIBA también procedió a articular acciones con la Universidad de la República, con los poderes públicos estatuídos, con la CEE -para el financiamiento de propuestas de investigación- y con el Banco Interamericano de Desarrollo (BID) -para obtener los recursos que posibilitaran implementar los Programas de Maestrías y Doctorados en ciencias básicas, eje para el cual resultaba cardinal contar con los científicos retornantes. Vale decir, cuasi como corolario, que el PEDECIBA supo constituirse en el proyecto unificante e integrador de la comunidad básica uruguaya. Para ello, por vías de distinta índole, generó las condiciones y alicientes que favorecieran el retorno al país de aquellos cientistas que estaban ubicados en el extranjero y deseosos de regresar a fin de contribuir para el reestablecimiento y el desarrollo de una práctica renovada.

A modo de conclusiones

Ha sido nuestra intención, en el presente trabajo, evidenciar cuán significativo resultó el proceso migratorio de la comunidad académica básica uruguaya ; y, particularmente, dar cuenta de la emergencia del Programa de Desarrollo de las Ciencias Básicas, por dicha comunidad gestado, como experiencia cardinal y viabilizadora del retorno de los científicos otrora radicados en el exterior.

La conformación del PEDECIBA, entendemos, reviste la mayor trascendencia por haber dado lugar al establecimiento de un espacio “instrumental”, generador de las condiciones idóneas para el regreso de una parcela importante de la comunidad. El Programa supo interpretar y traducir ; debiendo también destacarse que los cientistas retornaron porque veían la posibilidad de que sus actividades tuvieran una cierta acogida y recepción por parte del resto de la sociedad..

Así, vemos que era intención avanzar en cada una de las áreas específicas y más aún en el campo del conocimiento como un todo, siendo que los propios cientistas dan cuenta, a través de los relatos recabados, que las motivaciones del regreso cifraban esperanzas en la cración conjunta, en la re-creación de la ciencia como institución social, y en la contribución colectiva para el desarrollo de las ciencias básicas en el Uruguay.

Las articulaciones dadas en torno al PEDECIBA reflejan el esfuerzo sostenido por una pequeña comunidad que cuenta con escasos recursos, con crecientes sub-divisiones a su interior y con el anhelo de favorecer la generación de conocimientos y la formación de quienes en más han de ser los responsables por generarles. Pensándose en el desarrollo científico-tecnológico futuro y encuadrando el desarrollo de la ciencia en el país entre las muchas cosas que -aún hoy, junto a la reactivación productiva- éste debe promover para su aggiornamento.

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[1] Es de destacarse que en ocasión de la realización de este trabajo, y con el objetivo de recabar las opiniones y manifestaciones a las que de aquí en más referiremos o daremos cuenta, entrevistamos a un total de diecinueve (19) investigadores miembros del PEDECIBA. Las entrevistas realizadas fueron esencialmente abiertas, y del tipo “semi-estructuradas” ; siendo que los científicos entrevistados pertenecen a las distintas áreas del conocimiento contempladas en el Programa, según la siguiente distribución : 8 Biólogos, 3 Físicos, 4 Matemáticos, 3 Químicos y 1 investigador en Informática.

[2] Nótese que se entiende sobre el ethos de la ciencia “el complejo -teñido emocionalmente- de reglas, prescripciones, costumbres, creencias, valores y presuposiciones a los que se considera que el científico debe atenerse ” (MERTON, 1977, pág. 303).

Models of Scholar Migration from China

Paul Robins
Shaoni Tang

Historical Background

Following the turmoil of the Cultural Revolution, China resumed its programme of sending academically qualified students and scholars abroad to study. This became a key aspect of its educational reform, intended to provide the means of obtaining new knowledge and expertise from other parts of the world. The aim was first to compensate for the losses which occurred during the decade of the Cultural Revolution and second to import into China useful advances in modern science, technology and management. The incorporation of these would, it was hoped, enable China to modernise to the level of other advanced nations rapidly. With this as its main aim, the Chinese government has continued to send many scholars abroad in spite of the lack of national wealth and adequate educational funds.

Prior to 1949 China's education was already very backward compared to the western world. From the mid-1960's to the mid-1970's, China experienced the Cultural Revolution, in which Chinese education was upheld as a model of indigenous educational development through which Chinese intellectuals were prevented from suffering 'cultural alienation' and would therefore serve the needs of China's internally generated economic development. The economic mismanagement and political despotism of the period lead to a severely damaged education system and cultural impoverishment.

The Beginning of the Difficulties

In 1978 the Third Plenary Session of the 11th Central Committee of the Chinese Community Party made foreign study a focal point of its strategy for developing a world-wide economy and for realising its goal of modernising four priority areas, namely those of industry, agriculture, national defence, and science and technology. It was decided that China must accelerate its development of a large number of specialised and sophisticated academics while also strengthening its capacity to develop such high-level talent within China. Amongst the reforms initiated by Deng Xiaoping was the reform of China's educational system. While inspecting Qinghua University in Beijing in June 1978 he stated that it was the intention of China to send 300 scholars abroad each year although in reality ten times that number have been sent in each year since. Deng Xiaoping also identified the academic areas that needed input from foreign study but made it clear that the first priority should be the natural sciences and engineering technology. At all times emphasis would be given to those areas in which China was currently weak or which it needed to explore further.

The implementation of the policy was supported by the development of cultural and scientific co-operation agreements between China and foreign governments. For example Sino-American foreign study programmes were carried out, following the normalisation of Sino-American diplomatic relations, within the terms of the 'Agreement on Co-operation in Science and Technology', signed by Deng Xiaoping and former President Carter in 1979 (Clough

1981). Sino-Canadian foreign study programmes occurred within the terms of a memorandum on educational cooperation, signed in June 1979 (Hayhoe 1984). Sino-Japanese foreign study programmes were made possible by the normalisation of diplomatic relations between the two countries in 1972, but only occurred after the Chinese government signed a specific order in July 1978 [1]. Sino-British relations were organised within the terms of the 'Agreement on Cooperation in the Field of Education and Culture' signed in November 1979. This general agreement included specific agreements between the Royal Society and the Chinese Academy of Sciences, the British Academy and the Chinese Academy of Social Science, and the Confederation of British Industry and the State Economic Commission. Sino-German foreign study programmes were carried out within the terms of a national agreement on cultural cooperation signed in 1977 and Sino-French relationships were based on the terms of an agreement for cultural and scientific co-operation signed by representatives of the two governments in 1979 (Hayhoe 1984).

As a result of this policy China has, during the past 18 years, sent 250,000 students and scholars abroad to study in more than 100 countries but by the end of 1995 few had returned. Of the 250,000 scholars approximately 120,000 were sponsored by the Chinese government and institutions and 80,000 of these had returned. As very few of the privately sponsored scholars have returned there are about 170,000 remaining abroad, of whom 110,000 are believed to be in the US, 16,000 in Japan, 10,000 in Canada, 10,000 in Germany, 8,000 in the UK, 4,000 in France and 8,000 in Australia and New Zealand. The remainder are distributed throughout the rest of the world (Chao 1995).

Approach to the Problem

This failure of scholars to return promptly represents a loss or slowing of potential development in China. The work described here was undertaken to suggest ways of improving the situation, particularly where the scholars were supported by the Chinese government or universities. While China is actively encouraging study abroad, emphasizing its availability to all, it is essential to find ways of promoting return otherwise the anticipated benefits will not be obtained. The literature suggested that such control was difficult and others who have tried to exercise such control have based it on establishing either penalties for not-return or additional personal benefits for prompt return. Such measures are already being employed to a limited extent in China but they are particularly difficult to implement in this country due to its social and economic structure. It is difficult to make penalties or benefits sufficiently severe or attractive as, in general, there is insufficient personal wealth or advantage to be distributed or withdrawn.

An alternative approach to improving the return rate might be a more careful or purposeful initial selection of scholars if it proved possible to predict the likelihood of their return at the time of departure. This possibility originates from experience working in the International Exchange Office of Huazhong University of Science and Technology, Wuhan. Since 1978 there had been several policy changes related to the selection of scholars and informal observation of the effects of these suggested that some characteristics such as age might be reliable predictors. The primary aim of this study was to establish whether such prediction is possible. A secondary aim was to identify what if anything, might serve as a penalty or bonus in the management of China's foreign study programme. This would be based on an understanding of scholar aspirations and motivations while abroad.

The search for possible predictors of return rate was helped by variations in policy and its implementation which served to ensure a considerable variety in the nature and type of scholar foreign study. For example between 1978 and 1981, a small number of undergraduates was

sent to continue their studies to Master degree level together with some more experienced scholars, aged about 40. Most went to the US and Canada in disciplines related to pure science and languages. Later, in 1982, the Chinese government stressed the need for making a general plan which took into account all the factors needed for political and economic reform. These were to be used when selecting scholars and new, higher, targets for the number to be sent were set. Thus between 1982 and 1986 the number of scholars sent was the highest it had ever been, and included scholars of all ages and extended to those studying for post-graduate degrees. There was a shift in the disciplines involved towards the applied sciences, especially engineering and production related. Later in the period up to 1989 there was a further shift in disciplines towards those of particular practical use to China's advanced scientific technological development and less emphasis was placed on numbers. This period also saw a decline in government sponsorship of PhD study which was offset somewhat by an increase in sponsorship by China's universities or joint ventures with foreign institutions. As a result a large number of PhD students and visiting scholars continued to be sent to the US, Canada, Japan, the UK, Germany, France, Belgium and Australia. Engineering, production-related science and management were the main disciplines involved.

Since 1990 the general policy has been to support foreign study and increased international mobility but also to encourage prompt return to China. As this policy encouraged privately sponsored foreign visits the government reduced the support for PhD study but increased its sponsorship of short visits lasting six months or less. The majority of these sponsored scholars were sent to Europe and Japan, while the majority of privately sponsored students chose the US, Canada, Australia, Japan and the UK. The disciplines sponsored officially were advanced and sophisticated science and technology with increased attention to economics, law and management.

As the choice of destination for the scholars influences the financial costs the possibility of ranking destinations according to the likelihood of a prompt return is attractive. For example, the majority of Chinese scholars and students in Britain are financed by China involving heavy financial outlay due to the high fees for overseas students in Britain. Similarly the majority of Chinese scholars and students in France are financed by China but many of them benefit from the absence of tuition fees in French higher education. The American government does not provide any financial support to Chinese scholars and students, but many American institutions provide full or partial financial support. Germany provides the greatest level of financial support for Chinese scholars and students (Hayhoe, 1984).

Design of the Inquiry

In the light of this experience it was supposed that several easily identifiable factors might be associated with return rate. These were age, programme length, type of sponsorship and location of the study. Age was chosen on the basis that younger scholars had weaker links with China and might be willing to invest in significant foreign study. It was thought that longer study periods enabled scholars to identify suitable positions that enabled them to extend their leave although short study periods were difficult to use profitably if there was an initial difficulty with language or the cultural environment of the study institution. As the influence of an employing sponsor might have the same effect as family ties it was expected that sponsorship by an employing institution would give better return rates than simple funding arrangements. Location was of concern for reasons of cost as indicated above and also because it seemed easier to arrange extended stays in some countries due to their legislative frameworks. It was decided to search for such relationships in historical data and to complement that analysis with an initial inquiry into their explanation. This would take the form of a questionnaire sent to scholars on study leave in the UK.

Historical Analysis

The records of 2271 scholars covering the period 1979-1994 were examined to test for the existence of an association between the promptness of their return and the factors listed above. The sample was made up of records from several Chinese universities although the identity of the scholars was not known. The records consisted of the month and year of birth, the month and year of departure, programme type (i.e. whether study for postgraduate degree, visiting scholar and senior visiting scholar), location of study, the sponsoring body (whether central government or university), programme length, and month and year of return (an empty item in many records).

The records were separated to group together scholars that had returned promptly, those that had returned after a short delay and those that remained away for an extended period. For the purpose of this analysis a short delay was established as an extension of up to a half of the original study period. Such an extension would normally be granted on request. Delays greater than this were deemed to be significant and delays greater than about three times the original study period were defined as extended delays although such delays could not be identified in the whole sample. The sample of records was trimmed to exclude the records of scholars who were within the short delay category. Analysis of the sample showed that delays greater than within one and a half times the planned duration (4.5 years in the case of a PhD student) were generally many times the planned length. This left a total of 2035 records to be analysed, of which 1058 were of scholars who had already returned leaving 977 (48 %) still to return. Of those that had returned 610 (30 %) had returned without delay ; 338 (17 %) had returned within one and a half times the planned stay and 110 (5 %) returned after a delay greater than within one and a half the times planned stay. Of the 977 scholars still to return 241 (12 %) had not returned after ten years.

Age

The possible association with age was the first to be analysed as other factors such as programme type and therefore programme length were expected to be associated with age. Figure 1 is a plot of the proportion of scholars grouped according to age who delayed their return significantly. It is clear that the proportion is least amongst the 35 to 55 age group. The variability in the under 20 and over 50 age groups was thought to reflect the small numbers in the sample of these groups. A chi-square test confirmed that there was a significant association between the age of a group of scholars and the proportion of that group showing significant delay in their return.



Figure 1. Relationship between the proportion of scholars that delay their return and their age

The relationship between age group and the proportion of that age group that significantly delayed their return was calculated using a logistic regression. Using ordinary least squares a best fit line of W (x) =-4.74 + 0.127x was found where the logit was calculated as :

$$W(x) = \ln[(\text{non-delayed proportion aged } x)/(\text{delayed proportion aged } x)]$$

where x is the average age of the group.

The sample was divided into groups spanning a range of five years. The regression, drawn in Figure 2, shows that the linear expression is an acceptably close fit to the data although there is some indication of a slight 'S'shaped relationship. In order to estimate the proportion of an age group to show delay in their return the expression $W(x) = \ln[\exp(\alpha + \beta x)] = \alpha + \beta x$ was used to give, by a rearrangement of terms, the following estimated proportion of a group aged x to delay their return = $1/[1 + \exp(\alpha + \beta)]$

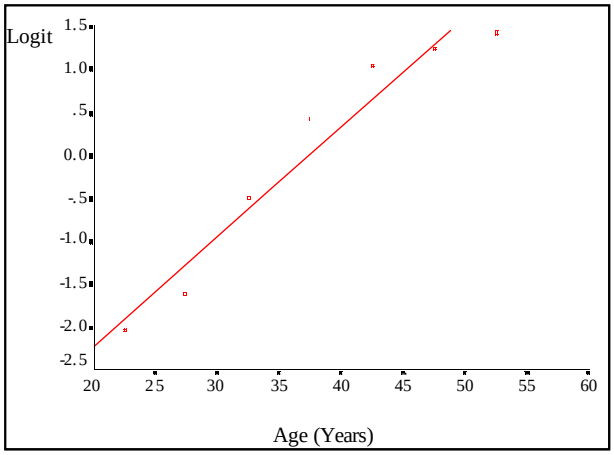


Figure 2.
Regression of the logit (W(x)) for each age

Using the slope and intercept values of the regression as estimates of α and β the relationship between delayed proportion and age was plotted as shown in Figure 3. This shows that younger scholars aged say 25 are more than twice as likely to delay their return than a scholar aged 40.

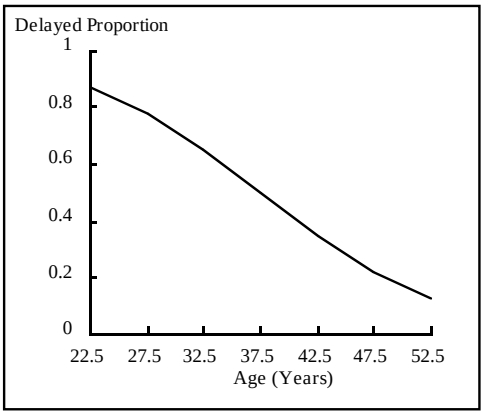


Figure 3.
Estimated proportion delayed against age

Programme Type

It was anticipated that age and programme type would be linked but the sample included a sufficient spread of ages for two programme types namely postgraduate study (typically a three year period) and visiting scholar (making no distinction on seniority). The length of study leave for visiting scholars was more variable but in general it was much shorter than three years, sometimes as short as three months.

The sample was thus divided into two and the logistic analysis repeated for each part. A clear relationship with age was found in both cases. The logistic regressions and the graphs of estimated proportion of scholars to delay their return are shown in Figures 4 to 7.

This analysis shows that scholars on a postgraduate programme are very likely to delay their return, remaining well above half for the over forties. Visiting scholars are less likely to delay their return, only the youngest showing rates as high as the lowest of the postgraduate students. The older scholars can almost be relied upon to return prom.



Figure 4.
Regression of the logit (W(x)) against age of PG scholars

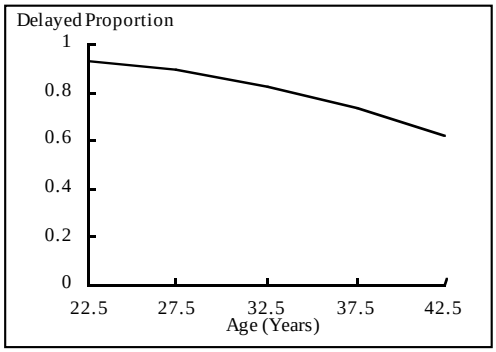


Figure 5.
Estimated proportion of PG scholars delayed for each age

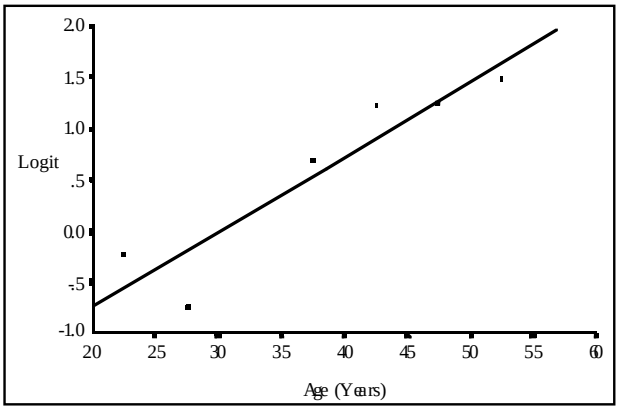


Figure 6.
Regression of the logit (W(x)) against age of visiting scholars

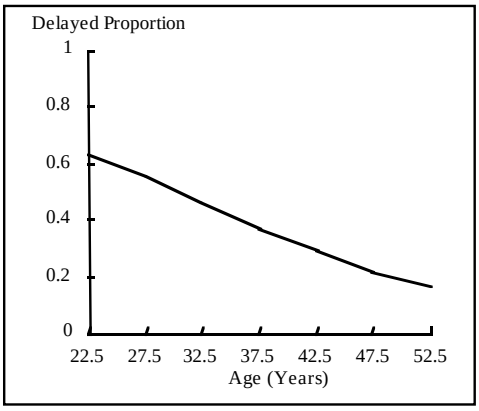


Figure 7.
Estimated proportion of visiting scholars delayed for each age

Programme Length

An attempt was made to establish if a direct link with programme length could be established by selecting a sub-sample of scholars within a narrow age range (28 to 32) shown in Table 1. Programme lengths were separated into five categories to represent programmes of up to 0.5 year in length, 1 year, 1.5 years, 2 years, over 2 years in length. PhD. students would fall into the over 2 year category ; Masters students into the 2 year category and visiting scholars may fall into either of the 1, 1.5 or 2 year categories. Senior visiting scholars, who would be associated professor or full professor in China typically fell into the 0.5 year category.

The age range was chosen to give the best representative sample of the programmes within a narrow age range but the sample was uneven in the numbers in each category, However the conditions for making a chi-square test were satisfied and indicated that there was a significant relationship with programme length. The sample shows increasing tendency to a delayed return as programme length increases except for an unexpected low value for the two year programme length. There is no clear explanation for this at present.

Table 1. Numbers delayed for each programme length category for scholars aged between 28 and 32

Length	0.5 Year	1 Year	1.5 Years	2 Years	2+ Years
Total Numbers Programme	19	141	15	47	140
Numbers Delayed	10	86	10	21	121
%	53	61	67	45	86

Sponsoring Body and Host Country

The sample of scholars contained 1248 sponsored by central government and 787 sponsored by universities. The proportion who delayed their return was 49 % in the case of government sponsored scholars and 60 % of those sponsored by a university. This difference was in part due to the different types of scholar in each group. Attempts to find a statistical significant difference when these differences were allowed for were unsuccessful.

Host country or geographical region was classified in the four categories for the purpose of this analysis. They were the US-Canada-Australia, Europe, Japan, and elsewhere. This grouping was determined first on the existence of similar immigration legislation governing the ability of a scholar to extend their stay and second on the need to have suitable group sizes for the statistical analysis. The return rates for these four regions were 42 %, 47 %,62 % and 61 % but the variation was such that no clear statistical differences could be identified.

Questionnaire To Find Explanations

The analysis of historical data was complemented by a short questionnaire designed to clarify or explain the results obtained. The questionnaire was in three main parts : the first asked for some personal details such as sex, present age and family status while the second asked for details of the programme of study including details of length of stay, sponsoring body, some details of their position prior to taking study leave. The third part sought to establish the scholar's intention with regard to their return home and to identify some of the considerations that influenced their choice. The questionnaire was distributed to 185 Chinese scholars studying in the UK and responses were obtained from 134 of them. While this response rate was very good

the types of scholars replying were very similar and some comparisons between this sample and the first analysis were impractical. However it provided some useful information as a pilot of a more substantial study that might be undertaken in the future.

Questionnaire and Historical Analysis Compared

When asked, 22 % of the respondents said that they planned to return home promptly, 32 % said that they expected to extend their stay by a short amount, 38 % hoped to extend their stay considerably and the remainder (8 %) were looking for a very long or indefinite stay. These figures are broadly similar to those reported from the earlier analysis but suggest a slightly higher delay rate that was found there. For comparison the earlier analysis found that 30 % had returned without delay, 17 % returned within one and a half times the planned stay and 5 % returned after a delay greater than within one and a half times the planned stay.

This difference may be inherent in the particular sample, reflecting the current nature of the scholar programme and the aspirations relevant to a single host country. However there is also the possibility that there is a tendency for studies to need extensions (in the eyes of scholars at least) and there might also be a desire to stay which is reduced by the practical opportunities. There is no discernible difference between the male and female responses.

The relationship between reported intentions and age of the respondents was also in broad agreement with the historical analysis. Scholars were asked to indicate their age by marking one of six age ranges. The sample included 2 (1.5 %) under 26 years ; 15 (11 %) were between 26 and 30 years, 70 (52 %) between 31 and 35 years, 39 (29 %) between 36 and 40 years, 4 (3 %) between 41 and 45 years and 4 (3 %) were over 46 years. The majority of respondents (81 %) were therefore aged between 30 and 40 years leaving many other age groups poorly represented. Some age groups have therefore been combined in Figure 8 which summarises the responses. The relationships between age, programme type, length of study and the respondents'intentions are summarised in Figures 9 and 10.

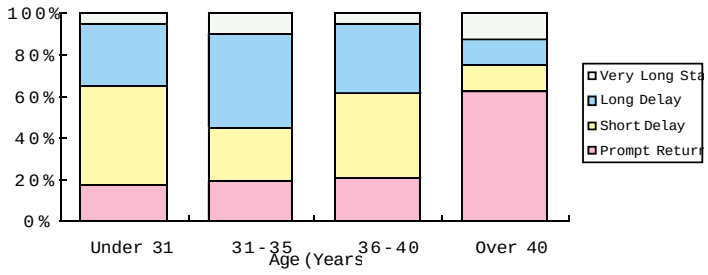


Figure 8 Intended behaviour of scholars grouped by age

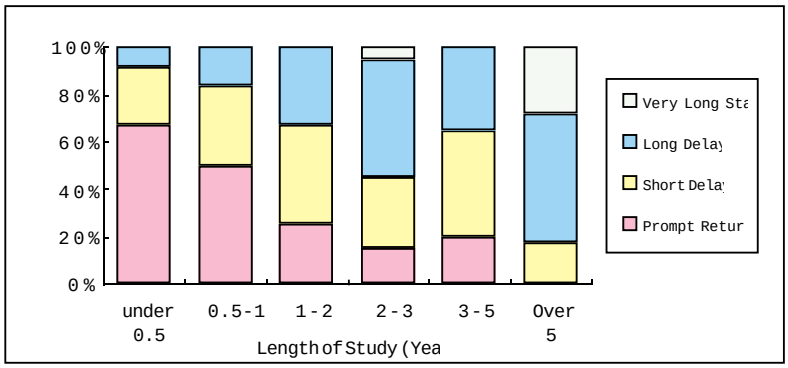


Figure 9 Intended behaviour of scholars grouped by length of study

The responses were much as was anticipated. Those on short visits intended to return promptly and the proportion declined as the study length increased. PhD students were the most likely to be seeking an extension to their stay while senior visiting scholars were the least likely.

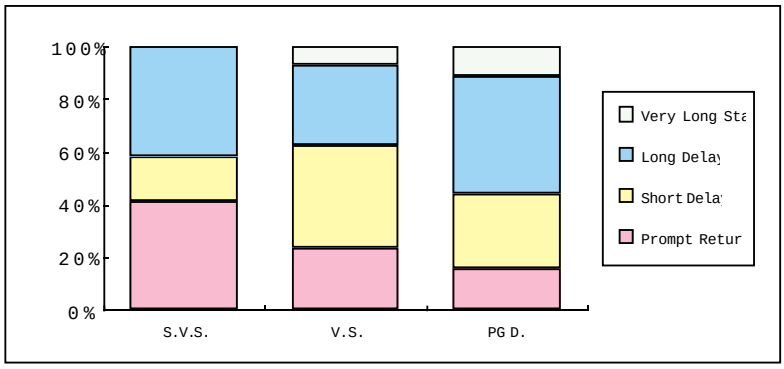


Figure 10. Intended behaviour of senior visiting scholars (S. V. S), visiting scholars (V.S) and scholars studying for Postgraduate Degrees (PG D)

Motivation of Scholars

The final section of the questionnaire asked the scholars to identify the things that they took into account when reaching their decision about returning home. Their replies are summarised in tables 2 to 5 which list those things seen as advantages and disadvantages. The lists are in order of the number of scholars selecting each item, the advantages being at the top and the disadvantages being at the bottom. Thus making changes to items at the top or bottom would be expected to have a greater effect, positive or negative, than those in the middle.

The original intention of the questionnaire was to identify motivational differences in the scholars that had made different decisions about the timing of their return. The results suggest that the differences are either personal or accidental in the sense that the particular circumstances of an individual enable them to balance future possibilities differently. The most striking feature is the general similarity across all categories of scholar.

The general conclusion is clearly that considerations of work opportunities, the availability of the necessary means of undertaking research is the topic that is a principle concern of all scholars. This concern is expressed in both positive and negative terms either as advantages in remaining or as difficulties to be overcome on return. There is a suggestion from the most frequently given negatives that the organisation and context of research opportunities in China is widely viewed as being in need of substantial improvement. In the eyes of many this is linked with concern for the general political situation and general living standards.

Table 2. Advantages and disadvantages given by the 29 scholars opting for a prompt return

Advantages	**Number**	**(%)**
Better professional opportunities in China	22	75.9
Raising my professional title	9	31
Stable job position and better quality of life	9	31
Higher social standing and respect	8	27.6
I have offers of funds for further research	6	20.7
Better opportunities for using ability to the full	5	17.2
I have offers of good accommodation in China	3	10.4
Disadvantages		
Difficult to transfer to a degree course	2	6.9
Honour agreement with my sponsor	4	13.8
End of financial support	5	17.2
Difficulty of finding suitable opportunity	7	24.1
Separation from my family and friends	11	37.9
Loss of job seniority in China	12	41.4
Education of my children	14	48.3

Other substantial issues are more practical concerning worries about family, children and the competition for advancement and opportunity. These are mostly seen in a negative light. Finally there may be some concern over more basic competencies such as language fluency.

Table 3. Advantages and disadvantages given by the 43 scholars opting for a short delay

Advantages	**Number**	**(%)**
More practical experience	31	72.1
More opportunities for earnings abroad	19	44.2
Waiting for my spouse to finish her/his degree	6	14
Other personal advantages	5	11.6
Disadvantages		
Other personal disadvantages	5	11.6
Lack of fluency in English	7	16.3
Lack of academic experience	12	27.9
Difficulty obtaining promotion	16	37.2
Difficulty obtaining funds for research	18	41.9

Table 4. Advantages and disadvantages given by the 51 scholars opting for a long delay

Advantages	**Number**	**(%)**
Increased academic experience	35	68.6
Good research conditions in the UK	28	54.9
A British degree is better than a Chinese degree	11	21.6
Higher earnings	11	21.6
Opportunity for spouse to obtain a British degree	10	19.6
Have won an award for PhD study in the UK	9	17.7
Other personal advantages	3	5.9
Disadvantages		
Other personal difficulties	3	5.9
Poor public infrastructure	4	7.8
Difficult for children to adjust to Chinese education on return	5	9.8
Competitiveness of securing research funding	9	17.7
Unable to find suitable work in China	11	21.6
No confidence in the present economic situation.	12	23.5
Lack of favourable political situation	15	29.4
Lower living standards	15	29.4
Poor research work conditions	19	37.3
Complex social relationships	22	43.1
Poor salary	25	49

Table 5. Reasons given by the 11 scholars opting for an extended stay in the UK

Reasons	**Number**	**(%)**
Better academic prospect	9	81.8
My child will have secondary or higher education in UK	1	9.1
Other personal reason	1	9.1

Conclusions

The analysis of the historical data suggest that it is possible to identify some simple criteria that would enable government and universities to exert influence over the return rate of scholars from foreign study leave. Age, length of study leave and the type of programme were apparently good predictors of likely return rate. The variety of policy changes in the recent past was instrumental in providing, within a manageable number of individuals, a wide variety of scholar and study leave for the analysis. However this variety also means that the situation being sampled was in a constant state of flux. It would be wise to confirm these results by further study before making crucial decisions based on them.

However this analysis may be used to guide foreign study policy. Without taking further control measures it may be possible to improve scholar return rates by limiting the age range chosen for sponsorship. An appropriate age range may be calculated on the basis of the expected value of a period of study leave. The results of some illustrative calculations are shown in Figure 11.

Calculating the Expected Value of Foreign Study

It is assumed that study leave of three years might be a suitable average to plan for as it represents a good balance between the time taken to settle and depart and the time available for productive study. The basic value to China of such study leave is assumed to be proportional to the number of years worked subsequently in China. Without delays it would be best to send young scholars as they have a longer working life ahead of them. In practice of course allowance must be made for the proportion of working life lost through delayed return. This is a simple calculation using the proportion delayed and age relationship established earlier (Figure 3).

The expected value to China is calculated as :

(retirement age - (age at departure + study duration))*(1-proportion delayed).

Retirement age is assumed to be 65, age at departure is a variable and the study duration is chosen to be the suggested three years plus the 50 % extension which would normally be given to complete a study. The proportion delayed varies with the age of departure and is obtained from the graphs shown earlier (Figure 3 for all kinds of study programme). The result of these calculations for ages of departure between 20 and 60 is shown in Figure 11. The Figure also shows the calculation allowing for a more generous extension to the basic study leave. In each case the implication is clear ; there is a range of ages between say 32 and 48 that will provide China with the greatest expected benefit.

Focusing Control Measures

This tentative result opens the way for setting targets for other more direct measure that might be taken to improve return rates. Figure 11 suggests a general approach to providing benefits or penalties as a means of encouraging return might be unnecessary. Measures taken to improve the return rate of the younger scholars would offer the best return for the effort involved. The results of model calculations that explore the sensitivity of the expected value of foreign study leave are

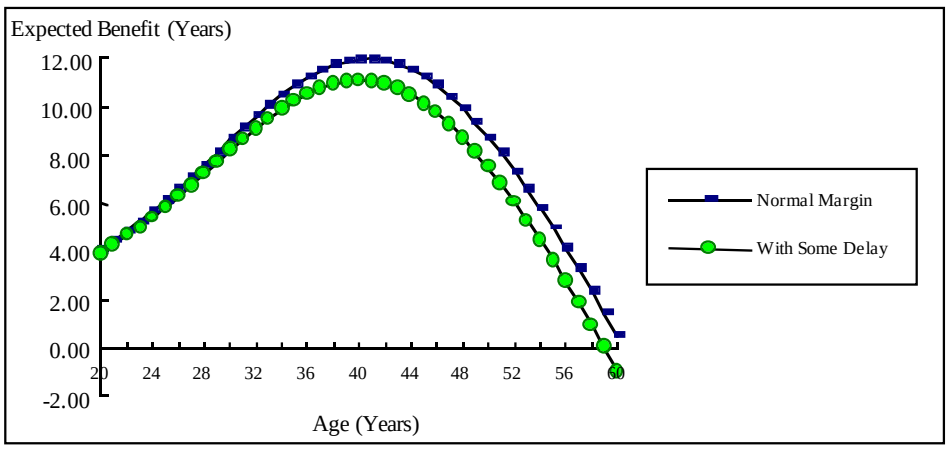


Figure 11. Calculated expected benefit of foreign study plotted against age of scholar

shown in Figure 12 An improvement of the return rate of 20 year old scholars of 10 % would double their expected value to China. While an improvement of 40 % may be ambitious there are clearly considerable benefits to be obtained by focusing the use of resources and administrative effort. There may be other advantages in focusing on the younger scholars, for example the cost of providing benefits on return are likely to be less for them than for more mature scholars.

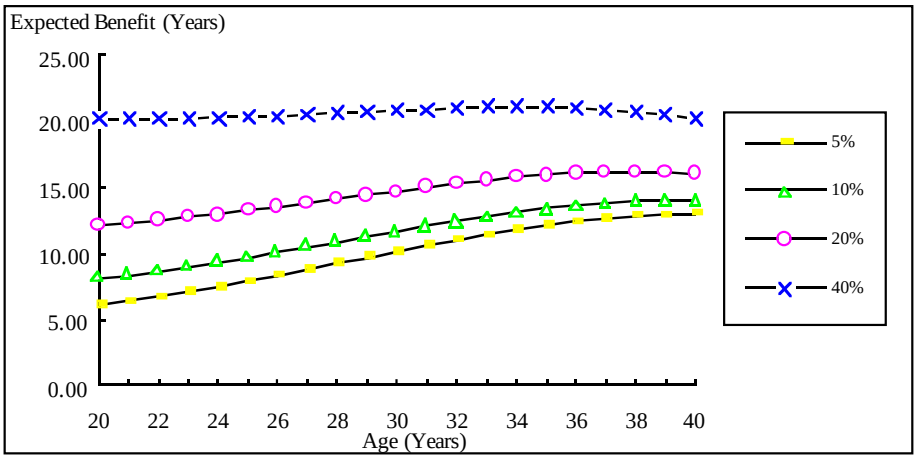


Figure 12. Calculated expected benefit for younger scholars assuming return rate improvements of 5, 10, 20 and 40%

Remaining Difficulties

However the difficulty of such change should not be underestimated. China's present social institutions are weak and in particular there is no strong legal system supporting management. As a result many laws and agreements are not adequately enforced. For instance, the agreement that enables foreign study was formulated by policy makers as early as 1987, including the terms of sponsorship. It explicitly states that sponsored students and scholars have an obligation to return promptly after completing their study and they must then serve for at least five years in their previous work unit. If they fail to do this their guarantors should refund all expenses to the sponsoring body. In practice this formal requirement, even though notarised by judicial authority, has not been enforceable. Chinese citizens do not have valuable private property so there is no significant action that could be taken by the legal system. This may change as the prosperity hoped for as a result of the foreign study programme comes into being but until then control of return rates will remain a considerable challenge.

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Reverse Brain Drain in Hong Kong?

Wenhui Zhong

Two important historic events have provided passionate reference points both for the Hong Kong residents who are immigrating and for whose who are returning from abroad. One was the *Tiananmen* Incident in June 1989, which ended with the bloody crushing of the student democracy movement. The other is the looming hand over of Hong Kong's sovereignty from Britain to China on July 1, 1997. The professional class in Hong Kong -engineers, scientists, academics, lawyers, doctors, accountants and managers- have been under tremendous pressure to re-evaluate their loyalty to Hong Kong.

Many have in fact voted on this matter with their feet. For those who have left Hong Kong in search of a better environment for career and family, adjusting to a new culture and coping with prolonged economic stagnation in the West has posed great challenges. By contrast, they saw that the economy in Hong Kong kept booming in spite of the political dark clouds hanging over the last days of this prosperous British colony. Thus the resulting reverse brain drain.

From the late 1980s, immigration to countries such as Canada, the United States and Australia became commonplace. And it was the professional class that benefited most from the generous immigration policies of these countries that wanted to attract skilled and wealthy people to boost their economy.

But into the mid-1990s, another trend was making itself increasingly apparent. Many of the Hong Kong immigrants, who had by now acquired a foreign passport as a kind of political insurance policy, were flocking back to Hong Kong for what they now saw as better career opportunities. They reasoned that should the situation in Hong Kong worsen to such an extent that they had to leave, they could always return to their adopted countries.

As Hong Kong thrives on its well-developed commercial resources and infrastructure, which in turn are skillfully managed by highly professional and cosmopolitan people, stabilizing the phenomenon of brain drain vs. reverse brain drain seems to be a logical priority for the present and future Hong Kong governments. However, there has been little research that provides a basic insight into the composition, mentality and dynamics of this important segment of the Hong Kong population.

This paper is an attempt to understand the Hong Kong returnees : their views on the future of Hong Kong, their career aspirations, their sense of belonging and their role in merging cultures east and west. Much of the data are based on my intensive interviews in December 1994 with Hong Kong professionals. These are supplemented by my continuing observation of Hong Kong affairs in the course of my radio production for the BBC World Service, which covers China and the Chinese people.

The 1997 Factor

In anticipation of the hand over of sovereignty back to China on July 1, 1997, many Hong Kong residents have considered immigration plans for themselves and their children. According to estimates by the Hong Kong government, there are about 450,000 foreign pas-

sport holders among the 6.3 million people in Hong Kong. But other sources, such as newspaper surveys, easily double that number to about 900,000. And these do not yet include holders of the British National (Overseas) passports offered by the UK to about three million Hong Kong residents as travel documents (but with no right of abode in the UK). The jittery mentality in Hong Kong was illustrated by the deadline of March 31, 1996 for submitting applications for the BNO passports. For a long time, many believed that the BNO passport was worth little because it did not allow the holder to live in the UK. Thus they waited until the last two days of the deadline and then scrambled to get one. After all, having one more passport still gave you that much more sense of security, however limited it might be.

But for those who have already solved the immigration problem -or some would even say, having served the immigration sentence (i.e., having met the residence requirements for acquiring a foreign passport), their major concerns are whether or not the 1997 hand over will be a deterrent to their future prosperity, should they decide to return to Hong Kong. I met in Hong Kong people from a cross-section of professions who had made the decision to return. They seemed cautiously optimistic about 1997.

One reassuring element for returnees working in Hong Kong is that most companies they work for are multi-national conglomerates. As Dennis Chiu of the Star TV network said, because the company had many operations in different parts of the Asia Pacific region, he felt he would have many opportunities to thrive in the company. And Hong Kong was not the only place he saw for career development.

Returnee lecturers in the seven universities told me that their cautious optimism rested on the belief that as long as they stayed away from politics they would be left alone. Though they expect some changes in high level positions, such as that of university president, they believed their expertise in teaching and academic research would be valued by the new government as important assets to keep Hong Kong competitive.

Perhaps Fai Au Yeung of the J P Morgan Securities Asia Ltd. reflects the mentality of many returnees when he gave this reasoning for his plan for 1997.

“ *I think 1997 is a factor, but it’s not a big factor. If I didn’t have a British passport, I wouldn’t have stayed here. I would have joined thousands of others in finding ways to get a passport or to get some insurance, so to speak. But will I plan to stay in Hong Kong for long ? I really don’t know. But one thing I know for sure. And that is : I wouldn’t buy a house here even if I had the money, because I still have some concerns for the future...I don’t care where I live. What matters to me is my job and career prospects. But of course, when you live in Hong Kong where you are among many friends, so much the better. I am still not planning to stay here for long. But who knows, perhaps after twenty years, I might still find myself here.* ”

Reasons for the Reverse Brain Drain

The single most often cited reason for returning to Hong Kong after a period of immigrant life in the West is for a better job prospect. To start with, most of the people I spoke with had been selected as immigrants under the “ points system ” by countries such as Canada, Australia and the USA, whereby candidates had to score enough points in areas such as job skills, language, and suitability to live in a foreign place. In other words, they are in a class of professional and skilled human resources that a modern, developed society values. In turn, this desirability by the industrialized world gives them the mobility to up-root from one place and settle down in another.

Most immigrants left Hong Kong, during the late 1980s, a time that coincided with the economic recession in most Western countries. It was therefore not surprising that most Hong Kong immigrants found it hard to get jobs suited to their experience and qualifications. And many had to switch to completely different jobs, accepting whatever was available. They said that this was the price they paid for their family and for the future of their children.

Esther Chow in the new City University of Hong Kong was such an example. She qualified for immigration to Canada in 1987 but did not leave Hong Kong until 1989, because giving up her job as an executive officer at a health centre was too dear a price to pay. After settling down in Toronto, she was in fact lucky enough to find a similar job, counselling Chinese immigrants. Her husband worked in real estate. Both seemed to fit into the Canadian society quite well as both had spent years studying for degrees from a Canadian university. But as soon as they fulfilled the requirement for a Canadian passport, they returned to Hong Kong for better career prospects, reasoning that in Canada, they could see where their careers would lead in the next 10 years or even to retirement. But in Hong Kong, the potential for change and the pace of development would offer them huge opportunities. And it was this kind of excitement and work ethic in Hong Kong immigrants that seemed to make them feel uncomfortable about missing out on the economic change taking place there.

Another reason often cited for returning to Hong Kong was related to the family. Even those who have lived in the West for a long time and feel well adjusted to the way of life there, had to consider how they should care for their elderly parents. Some have made arrangements for their parents to live with them but find that the elderly members of the family would rather live in Hong Kong in the familiar linguistic and cultural milieu. The strong sense of filial piety and family responsibility dictated that someone from the family, preferably the oldest daughter, should not be too far away. That sometimes meant they could live together in Hong Kong, which solved the expense and problem of finding another accommodation.

For those born in the West, another reason is returning to their roots. Others want to offer their children a Chinese learning environment, and make a lot of money before retiring to the safe havens in the West. The main barometer for Hong Kong's viability, its economic growth, has been strong, despite political hiccups and fears that the Hong Kong way of life would be lost after 1997. As professionals, most returnees would have established their careers before returning to Hong Kong. For many, they had to balance between maintaining a stable but less upwardly-mobile career in the West and taking a somewhat unknown but potentially rewarding chance by returning. But for some, the process of reverse brain drain has been a long and determined one.

For example, George Yip, a lawyer in Hong Kong told me that after living in Australia for more than 30 years, he still needed to take an examination in London to qualify for private practice in Hong Kong. Otherwise he would have to work for seven years in the Hong Kong law department before being allowed private practice. He said that he saw great potential for legal work in Hong Kong as the whole system had to be made suitable for the new government after 1997. And it was with this conviction that he took the trouble to prepare and successfully sit the examination in London before going back to Hong Kong. Job satisfaction from contributions to the legal reform in Hong Kong, from working with academics and legal professionals in China, surpassed any sacrifice he had to make, he said. Mr. Yip further explained that he enjoyed an enormous sense of job satisfaction from a positive and substantive input into the legal reform process. He saw his value in the experience and familiarity with Western legal concepts and international conventions, which needed to be critically evaluated and incorporated in the new system. This substantive contribution through actual legal practice and consultation with legal experts in China, Mr. Yip believes, was better than acting simply as an on-looker, criticizing and commenting from a distance.

It seemed to me that although better financial rewards play a role in the returnees'decision for the reverse brain drain, a deeper level of job satisfaction and the belief of greater career potential in

the future stands out as the most important factor. This combined with their immigrant experience, in which the economic downturn and cultural adjustment in a new country may have pushed their desire to go back to Hong Kong for a second chance. In order to investigate this aspect of the immigrant psychology, I asked my interviewees about their sense of belonging. In other words, how do they see themselves : whether they perceive themselves as Hong Kong residents, citizens of their adopted country or world citizens who possess the skills best suited to the needs of Hong Kong ?

Sense of Belonging

Many of the Hong Kong professional returnees who have filled important positions in scientific, medical, legal, business, financial and management fields received their education and training in the West. Some had substantial working experience in big multi-national companies. But their personal up-bringing and cultural heritage has been largely Chinese. For them, the process of immigrant life had brought to greater relief the continuing process of re-affirming and re-establishing their personal identity. Some found integration into the mainstream culture in the West easy and suitable to their personality and values, while others never felt comfortable with the life-style, work ethic or the general value system of their adopted land. However, without a systematic measurement, no pattern has emerged whereby the cultural orientation or psychological traits of the returnees can be summarized. I will, nevertheless, offer a few observations by way of illustration.

Dr. Donald Tang returned to Hong Kong to be a lecturer at the Hong Kong Polytechnic University after serving more than 20 years with a big company in Australia. Even though quite comfortable in a senior position of the company, Dr. Tang felt that he lacked challenge in the generally more laid-back environment there. He particularly disapproved of the welfare state system there where he felt the hard-working must subsidize the lazy through a harsh income-tax regime.

On the other hand, Mr. Fai Au Yeung at J P Morgan Securities immigrated at the age of eight, and went through a process of negating his own Chineseness only to become more aware of his own cultural heritage. During his school years, he deliberately distanced himself from anything Chinese and tried to be like the other boys, adopting their mannerism, their language, their tastes and hobbies, etc. while avoiding any Chinese friends. Sometimes he felt he was “ white. ” He was particularly against a common phenomenon in the West where many Chinese socialized with their own by forming Chinese societies, clubs, etc. only to find themselves isolated in the Chinatown ghettoes, outside the mainstream culture.

For someone as well integrated into the mainstream culture as Mr. Au Yeung, why was it necessary to go back to Hong Kong ? Well, a perception of racial discrimination seemed to be at play. Mr. Au Yeung said that as he rose through the ranks in a merchant bank in the UK, he felt he had reached a glass ceiling. He had to work extra hard to get the credit he deserved. And even though there was no hard evidence, to him, the sense of racial discrimination was palpable. That kind of feeling actually turned his interest into finding out more about who he was, and his interest in China and Chinese issues grew. For a while, Mr. Au Yeung had difficulty reconciling his cultural affiliation : whether he was Chinese, Hong Kongese, or British. In the end, he gave up the effort because now he saw himself as a human being with a unique set of values and skills.

This mentality, as I discovered, was quite common among Hong Kong returnees. Even for those who had grown up and worked in Hong Kong, immigrant life in the West had changed their perception of the self. To be sure, some claimed to be more Canadian, American, or English than Chinese in their cultural traits, while others claimed the opposite. But they no longer saw themselves as a “ true ” Hong Kong resident or a “ true ” Westerner.

On the issue of discrimination, most interviewees felt that it was more a perception than a deliberate or tangible act. And this belief was closely related to the process of cultural integration in their immigrant life. Patrick Chan was a returnee from Canada working for a Hong Kong government department. He recalled that he had the feeling of being discriminated against soon after he immigrated. He was overcome by a great sense of frustration while looking for jobs, as many employers required Canadian experience. But when he later became more integrated in the country, he as he saw it was whether as an immigrant he regarded himself an outsider or part of the community. Anyone who treated himself as an outsider in the first place could not expect others to treat him as an insider, he said. To him, a lot of the perception of discrimination started with self-discrimination. And Mr. Chan said that by taking the citizenship of a certain country, an immigrant had sworn allegiance to that country, embracing its cultural values at the same time. And that, in theory, should be the culmination of the process of cultural integration.

Professionals from Mainland China

Among the returnees to Hong Kong, a significant minority are people who were born in China but had spent a number of years in the West studying and working before being attracted to Hong Kong. And since 1990, the Hong Kong government has adopted a policy of accepting a very limited number of senior professional people directly from China to fill in some important positions. Here we are not concerned with them, but with mainland Chinese " returning " from the West. Most of these expatriates with a mainland Chinese background came to Hong Kong with a foreign passport or permanent resident status in a Western country.

In the academic world, the expanding university system has been actively recruiting people from the West in order to maintain a standard comparable to universities in Europe and North America. And it is here that many mainland Chinese were attracted. For one thing, the financial reward of working in a Hong Kong university was among the highest in the world. Secondly, some of the Chinese students who had left China for the US, Canada and Western Europe in the 1980s for overseas graduate studies found that upon completion of their Ph.D.s or even post-doctoral research, academic jobs were far from plentiful in the West. Thirdly, the combination of knowledge about China or the Chinese way of thinking on the one hand, and Western education and training on the other puts them in an advantageous position in Hong Kong, the gateway between China and West. Finally, those who could neither integrate in the West nor tolerate the political restriction in China, found Hong Kong a happy compromise.

Dr. Xiaobin Zhao, a lecturer at the Hong Kong Baptist University, told me excitedly that a researcher of social scientific issues of China, he found Hong Kong the best place in the world, with its proximity to China but without the ideological strait jacket one would find in the Chinese academic world. He said that,

" *living in Hong Kong, you can feel the pulse of China. you can feel how severe high inflation is or how serious a political or economic situation has developed. You just can't help but feel it. The first hand information you can so easily obtain is vital to the social sciences researcher. But if you are in the US, you will probably get second- or third-hand information. And you might find it too late even when you get it.* "

But in anticipation of the hand over of Hong Kong back to China in 1997, people in the social scientific fields have begun to feel the pressure of self-censorship. Some newspapers and magazines have been forced out of business by the withdrawal of advertising funds from companies that did not want to be seen supporting dissident media. Even the government-funded television station RTHK has been demanded air time for pro-Beijing propaganda.

But David Tsui, who received his B.A. in China and spent years in the USA and UK while doing graduate studies, believed that there was a place for people like himself to help bridge social scientific knowledge between China and the West. The journals he published in Hong Kong, *Chinese Social Sciences Quarterly, China and the World* and *Chinese Book Review,* brought together scholars from China and the West to the same forum to discuss and debate issues of common interest. Mr. Tsui said that at the beginning, there were concerns that his academic journals might suffer from censorship by authorities in China or self-censorship by contributors. But later he discovered that with the relatively more liberal atmosphere in Hong Kong, there was a welcome need to introduce new social scientific information and international standards to China, and to introduce Chinese scholarly works to the West. As an example, he said finding a consensus about the proper way to present ideas in academic journals was one of his achievements.

" In some articles, the authors from China used other people's quotations without attributing them to the original source. They considered this too pretentious or unnecessary. Even some senior scholars held this viewpoint. But we told them that it was absolutely necessary because you needed to show how your own thinking had developed and how you built on other people's previous work to push the frontier of knowledge forward. "

With a network of friends, colleagues and family members in China, the Chinese overseas student returnees in Hong Kong are well positioned for the future, when Hong Kong's interaction with China will accelerate. Dr. H. Leung of the Hong Kong Polytechnic University said the network of alumni had helped him establish academic links and joint research projects with China. His mainland Chinese background also helped him in the hiring of a research assistant from China, who was more dedicated to the work at hand because of the Hong Kong immigration restrictions on alternative employment for mainland Chinese workers in Hong Kong.

Due to the linguistic and cultural differences between Hong Kong and mainland China, Chinese overseas student returnees had to put up with some inconveniences in their daily life. Ms. Dian Wang, senior legal counsel at the multi-national company Duracell, told me that fortunately, the language at work was mainly English. She had no difficulty at all communicating with her colleagues. And once in a while, she would use Chinese in writing letters to clients in China. But for life in Hong Kong outside work, Ms. Wang had this observation :

" Over the years, I have noticed some changes in the way ordinary Hong Kong people treated people from mainland China. When I first came to Hong Kong in 1987, there was a very clear line between Hong Kong people and mainlanders. Some shop-keepers were very reluctant to serve you when they knew that you were from China. We were treated like second class citizens or country bumpkins. But now you can see signs 'Chinese money is welcome !' and 'Putonghua (Mandarin) spoken !' everywhere — in many department stores, restaurants and jewellery shops ".

Westerners in Hong Kong

The Hong Kong government's policy to localize the civil service has resulted in some of the highest level positions being filled by local Hong Kong residents. This trend seems to be in line with the looming transfer of sovereignty in preparation for future status as Special Administrative Region of Hong Kong. As some of those colonial officials are packing up to return to their motherland ; other Westerners continue to arrive in Hong Kong to take up new opportunities. One such person was Christianne McFarlane from Canada, who is married to a Chinese Canadian. Here is what she saw as opportunities for her :

“ The reason why my husband and I decided to come to Hong Kong was that both of us speak a background in fine arts, he has found a job in an interior design company. And I am working for Star TV, something related to what I did for the Canadian Broadcasting Corporation back in Canada. ”

But there were challenges living in this densely populated city of 6.3 million. The pollution level, the high cost of living, and the political uncertainty were the trade-offs, but considering the career rewards, Ms. McFarlane said that it was worth the risk. She added that because she and her husband had lived in China for a long time, they were more prepared than others to deal with an authoritarian regime.

Interracial marriage has added a sense of multi-ethnic community in Hong Kong which, compared with China just across the border, prospers on pluralism. Another interracial family, the Glasspools, had lived in the UK for 16 years before coming to Hong Kong. One reason for the big move was so that their children could have the opportunity to be exposed to the Chinese linguistic and cultural environment. There were at times adjustment problems for the family trying to adapt to the social etiquette in Hong Kong. For example, they found they had not been spending enough time socializing with their colleagues and friends at dinner parties as local custom dictates. And their children found that frequently losing playmates and friends because of the mobile expatriate community was too stressful psychologically. So as if by instinct, they gradually established for themselves a network of friends who were neither totally native nor totally Westernized but a group of people with an understanding of the inter-cultural predicament.

Another type of Westernized people in Hong Kong are ethnic Chinese who were born and raised in the West. They came to Hong Kong partly to seek their cultural roots and re-assert their Chinese identity. To their delight, Hong Kong was quite receptive to this group of Chinese-looking people who in fact could not speak Chinese. Derek Yao was one such person. He had been made redundant in the UK before joining a management consultants firm in Hong Kong, where at the age of 28, he was given the responsibility of heading a team of Hong Kong colleagues. Apart from job satisfaction, Mr. Yao mused that he was actually doing what his father did decades before : trying to make a mark in an alien culture. As his father could not speak English, Mr. Yao wanted to find out more about the early experience of living in Hong Kong and to understand why his father had to engage in selling opium to “ white people ” at the time. The discovery of the past, the culture, the ancestry and the self in Hong Kong seemed to have some positive therapeutic effect on the self esteem of Chinese born in the West.

I was told by some of the interviewees that Hong Kong had been attracting more and more Westerners to do very ordinary work, a fact that contrasted quite sharply with the past when the senior positions were reserved for Westerners. For example, it was pointed out to me that Westerners could be seen in tourist areas hawking food. And another interviewee told me that when he advertised a secretarial position for his company, he received about 200 applications, most of them from Westerners. The relative receptiveness of Hong Kong to Western ideas and people was perhaps a reflection of its reputation as an international financial centre. Whether this competitive edge of pluralism can be maintained will hinge on the ability of Hong Kong to retain that cosmopolitan mix of professionals.

“ Astronauts ”

The decision to return to Hong Kong was by no means an easy one for many returnees and their families. Usually, one member of the family in their adopted country (in most cases the husband) spotted an opportunity for career development in Hong Kong and wanted to try to see whether it would be worth moving the whole family later. Thus began the life of an “ astro-

naut, ” a frequent flyer between Hong Kong and the country where the family lived. This kind of lifestyle has had a detrimental effect on many immigrant families. The absent parent(s) made it easy for youth gangs to influence school-aged children. In Canada, the country of first choice for most Hong Kong immigrants, youth gangs have targeted Hong Kong immigrant families so successfully for crimes such as extortion and fraud that some police departments set up special task forces to deal with this new social problem.

Therefore, many “ astronaut ” families tried to shorten the period of this lifestyle and become reunited as soon as possible. But even within a period of a few months’separation, the disruption from an “ astronaut ” life-style on a normal family could be quite considerable. The Yau’s are such an example. Almost as soon as Dr. Wing Yau left London for an editorial job for a trade magazine in Hong Kong did his wife Ada and young children begin to feel the effect. Here was what Ada Yau said :

“ Immediately, the house seemed so empty, and how lonely my sons and I felt ! We suddenly lost someone to talk to and to rely on. And of course, there seemed to be more problems when my husband was absent. The car broke down one day, and I didn’t know what to do because normally my husband would be there to handle it...There was something wrong with the heating system, and I had to make a long-distance call to Hong Kong to ask him what to do...And my older son who is 10, missed his father so much that he kept asking when Father could come back, and I noticed him crying at night for not seeing him for so long. ”

As a matter of fact, the Yau’s had lived separate lives before, when for a while Dr. Yau had worked for a company in Manchester Monday to Friday and spent the weekend in London with his family. However, the distance between Hong Kong and London made it harder for him to shuttle back and forth as often as he would like to. Dr. Yau explained his feelings :

“ Initially, you would feel you had a little more freedom to be with friends and ssociates, to go month later, the loneliness began to creep in. You missed the family. And when there was an emergency back home, like the heating problem, you felt helpless. All you could do was to make more and longer phone calls. After a while, you might wonder whether you were working so hard just for the telephone company. Sometimes, in a quiet moment, I couldn’t help questioning myself : considering the cost, is it worth it ? ”

But another family, that of Dr. Peter Yu of the Hong Kong Polytechnic University, did not seem to suffer too much the effect of the “ astronaut syndrome. ” The reason, according to Dr. Yu, was the age of his two children. One of them was in the third year of university in Canada, while the other was in the last year of high school. That meant that the children would be in Canada for a while. And both he and his wife would shuttle between Canada and Hong Kong. It seemed clear that the demand of the parents’time by the Yu children was significantly less than that needed by the younger children of the Yau family.

To Leave or to Stay?

The push and pull factors are still playing out their forces and influencing the increasingly mobile professional class in Hong Kong. The “ one country, two system ” formula guaranteed by the Basic Law (a mini-constitution) for post-1997 Hong Kong promises to keep the present capitalist system in Hong Kong for at least 50 years. But at the same time, Hong Kong residents have noticed to their dismay events that have shaken their confidence in the integrity of that guarantee. Now it seems quite certain that the elected Legislative Council (parliament) will be replaced by one appointed by a committee that was hand-picked by Beijing. There are signs

that the press will be less free, with pressure increasing for censorship and self-censorship. And the fear that rule of law might be encroached on by the presence of the Communist Party in the legal system. The fear of the loss of independent legal and judicial power to fight corruption is perhaps the most realistic one, because most Hong Kong people attribute the city's success to a just and laissez-faire government.

For most in Hong Kong returnees who already have insurance policies in a second country, their plan is to stay in Hong Kong as long as they can until such time that the situation reaches a level beyond their tolerance. But according the president of the Hong Kong Alliance for Chinese Expatriates (ACE), Mr. Guy Lam, this mentality can be a kind of self-deceit or self-assurance rather than a practical solution. He said that

" many members and friends are lawyers and medical doctors. The fact that they have returned to political risk. After a number of years, if they suddenly decide to go back to Canada, US, UK or Australia, how can they re-establish the same network of clients ? If they want to retire or are prepared to start all over again, that will be fine. But it would be wishful thinking to expect that you can simply pack up and go without sacrificing much of your career. "

It is professional organizations like Mr. Lam's that will be playing an important role in lobbying for the interests of returnees. The legal status of returnees who are foreign passport holders as permanent residents of Hong Kong has been fought and gained partly through heavy lobbying of various professional bodies. Even the Hong Kong civil servants have not been immune from political interference when a high- ranking official from Beijing demanded their pledge of support for the Provisional Legislative Assembly to replace the elected Legislative Council. And again, their solidarity and professional reputation eventually saved them, making Beijing retract that demand.

There is no doubt that one element contributing to Hong Kong's unique place in the world, and in relation to China, is its ability to attract a dynamic and cosmopolitan group of professionals working in the financial, legal, public civil, and other sectors of society. And Hong Kong likes to pride itself on its professionalism and efficiency that rivals counterparts in the most developed countries. Recent statistics point to the fact that Hong Kong people have a better income per capita than citizens living in their traditional colonial home country, the United Kingdom. Despite criticism about the lack of a social welfare system to protect the sick and the poor, and despite being mocked for their workaholic lifestyle and crowded living conditions in a polluted environment, people live longer in Hong Kong than in the UK, let alone most parts of the Asia Pacific area.

The flow of professional people in and out of Hong Kong will probably continue after the sovereignty hand over. As professor S. L. Wong of the University of Hong Kong points out, the immigration policies of Western countries such as Canada, the US and Australia to attract professional people will not change in the near future due to their self-interest. And the annual immigration level in Hong Kong over recent years at about 50,000 to 60,000 is a reflection of those policies. One important effect is the increased mobility and internationalization of the Asia-Pacific middle class.

Running Head: Back-and-Forth Perspective “Back-and-Forth” as a Viable Alternative to the Brain Drain Perspective, with Chinese Examples

Paul Pedersen
Ko Shan Lee

The “ brain drain ” controversy has polarized the self interests of countries that *send* students abroad against the best interests of countries *receiving* those students into a win/lose competition with the students themselves as the prize. This false dichotomy ignores the long term importance of regional interests and the role of international students as links between countries throughout the region in favor of short term national expediency. For some countries the possibility of a delayed return may be a viable and more accurate alternative to “ brain drain ” for understanding the potential of international educational exchange (Pedersen, 1992).

The “ brain drain ” concept encourages wrong thinking. (1) It does not distinguish between delayed return and permanent non-return in compiling data. (2) It *overemphasizes* the migration of students from sending countries and *underemphasizes* the migration of ideas from receiving countries. (3) It is pejorative in assuming that non-return or delayed return is an intentional exploitation by more industrialized countries. (4) It exploits the sensational slogan aspects of student migration. (5) It creates barriers to the international exchange of students. (6) It assumes a zero sum win/lose competitive relationship between sending and receiving countries.

As we become more aware of regional identity and multilateral dependencies we should move away from the divisive arguments about “ brain drain ” and identify alternative models that allow the sending and receiving countries as well as the students themselves to benefit. There is a third alternative to either returning home or staying abroad. That third alternative is the “back-and-forth” model, where the graduate has the freedom and opportunity to travel back and forth between the home country and the host country as a visible link between the two countries and professional communities. In this way both the sending and the receiving countries benefit from the student as a conduit of professional communication to their mutual advantage. There is data suggesting that many of the students whose delayed return after graduation has been of concern to sending countries, would be willing to return home if they were sure that they would have the freedom and opportunity to go back and forth between the home country and their professional communities abroad.

What is the role of Chinese students studying abroad ?

Since the earliest Chinese students began studying in the U.S. authors have debated the problems of Chinese society absorbing the skills and ideas of returned students from the U.S. The issue is even more urgent today. In 1994-95 there were 39,403 students from the PRC studying in the U.S., which is a 11.2 % decrease from the previous year (Zikopolous, 1995). In 1990 there were between 32,000 and 45,000 Chinese students studying in the U.S. Even at the height of Sino-Soviet relations, as a point of comparison, there were never more than about 500 Chinese students studying in the Soviet Union at any one time. The influence of Chinese students into the U.S. reflects a serious commitment to a Western style of education more than ever before, which has become apparent when those students return home.

Between 1978 and 1988 approximately 12,500 students with J-1 visas and 7,000 students with F-1 visas returned to the People's Republic of China (Orleans, 1988, p.13). Until recently there was no " brain drain " problem in China and the student graduates would almost all return to China. Since the incident at Tienamen Square however, there has been a great deal more concern. Tienamen politicized international scientific and educational exchanges and coincided with social and ideological changes to polarize Western and non-Western perspectives in China. Chinese students in the U.S. have been granted special privileges to delay their return, in part at least out of sympathy for their welfare in the current crisis. Prior to the student demonstrations in the winter of 1986-87, virtually all the officially sponsored students and scholars returned to China after completing their studies. Now many Chinese students studying in the U.S. seem to be taking a " wait and see " attitude and are tending to delay their return to China (Zweig & Chanqqui, 1995).

The threat of a brain drain is particularly feared in the area of science and technology. Li Xing (1991) suggests that students in scientific fields have delayed their return because of (1) a lack of trust in Chinese leadership by students abroad (2) a lack of advanced professional opportunities in modern China and (3) the increased popularity of a more self-centered and independent perspective among young people in China. Given the delayed return of students abroad universities in China are less likely to risk sending junior faculty abroad —-especially if these faculty were supporters of the Democracy Movement.

Those students who have already returned to China have been mostly " visiting scholars " who completed their studies in relatively short stays abroad. Few of the privately or self-financed students have come back and recently even government sponsored students working toward graduate degrees abroad have been requesting an extension of their stay abroad (Pedersen, et. al., 1991). There is a need for trained scientists and engineers, especially in many less prominent institutions, but foreign-trained scholars might not find these attractive. Although there is concern about the delayed return of Chinese students abroad the situation for China is far from desperate.

What is being done to encourage return?

As a result of the delayed return of students studying abroad, China has tended to encourage study abroad only in applied fields, decreased undergraduate or masters level quotas and increased the number of older students studying for the doctorate. China is encouraging students to return from abroad by setting up post-doctorate research stations across the country and a National Service Center to assist the returned student. There is also a tendency to send students

to Europe, New Zealand, Australia or Japan rather than the United States, presumably out of fear that students sent to the U.S. will be less likely to return home after completing their studies.

It is important to understand the role of Overseas Chinese students from the China viewpoint. Western thinking and theories of development present a threat to traditional Chinese society. Western aid-giving countries have tended to assume that genuine modernization will ultimately mean China's becoming " more like us, " but that may not be true. Modernization will result in changes favorable to foreign-trained intellectuals now waiting to return from abroad but advocates of the old ways will lose power. China is going through a fundamental and irreversible transformation in its attitude toward knowledge and its use which will favor Westernized intellectuals. Many of these Western trained intellectuals will eventually return from abroad because of loyalties to China, disillusionment with the U.S. or out of attraction to professional opportunities. When they do return they will be better prepared to contribute because of their delayed return, at least from a Westernized perspective.

To understand the role of the Overseas Chinese students and scholars it is important to consider educational reforms now being encouraged for domestic university education in China. It does seem that the PRC government's original conservative policy will be relaxed, even though the implementation of the new policy may be more liberal in some places than others. There is an attempt to change the university system in China to be more in line with a market economy, and capitalist-style market reforms. The new educational policy aims at training more students in economic-based subjects and instituting a U.S. style " pay-to-study " system at the university level. More private universities, more foreign investment in educational institutions, and more independence by universities are expected to result from this new policy to establish " an education market " in the PRC.

The development of rural enterprises and joint-venture firms has led to a shortage of qualified experts. Xinhua China News Agency claimed China has only 1,075 universities and 2.05 million students which would be less than 1 percent of China's 1.1 billion population. The new reforms seek to develop key universities to " world class " status by the end of this century. Teachers are to be treated as scholars and are being promised equitable pay. The PRC government is also trying a variety of other methods to increase the likelihood of students returning home after study abroad.

First, the responsibility for selecting students to go abroad has been shifted to individual work units, requiring signed contracts between the individual and the unit assigning responsibilities and sometimes requiring a guarantor.

Second, graduates from Chinese universities are routinely required to work for two years before going abroad for an advanced degree.

Third, there is a concerted effort to improve the living and working conditions for all intellectuals.

Fourth, there is a tendency to prefer advanced students and scholars rather than undergraduates as candidates for study abroad, except in language study and specialized areas.

Paul Ong and his colleagues (1991) point out that everybody potentially benefits from the migration of highly skilled and talented graduates. The effective transfer of technology requires an exchange of ideas and people. If graduates who remain abroad create a loss of manpower for sending countries the graduates who return home create a transfer of technology problem through the transfer of ideas from the country where they studied. Whether the Overseas Chinese students go home or stay abroad they offer the opportunity to link both sending and receiving countries in fundamental ways. Since the mid-sixties the migration of talent has been much more fluid and two-directional with migrants going back and forth. Whether the graduates stay abroad, return home or delay their return home need not diminish their contributions at home and/or abroad.

What do students need to return ?

There is much concern in the PRC for the younger graduate students now completing their studies abroad, many of whom are not married or attached to a work unit. There is an expectation that these students will continue to delay their return to China for an extended period of time. An increase in " business fever " among Chinese youth seeking the " good life " of professional and personal affluence has increasingly become a factor in the decision about whether to return or not.

1. Government employees with a college or university education now earn only about 83 percent the life income of their peers with a junior middle school or lower level of education. The graduates want an equitable salary.

2. Some young instructors at Beijing University do not have an apartment of their own even after ten years of marriage because of the severe housing shortage. The graduates want assistance in finding adequate living arrangements.

3. There is little opportunity for young professional academics to be promoted, prompting them to look for opportunities abroad. The graduates want an opportunity to develop and progress professionally.

4. Many research institutes and universities are over-staffed so that even graduates with Ph.D. and Masters degrees find it hard to get a job in their field. The graduates want to delay their return until an appropriate position is available.

5. Research institutes in the natural sciences have been unable to update their equipment in recent years because of diminished funding. The graduates want access to modern equipment.

Not all returned graduates would be welcome. There is a concern in the PRC that monetary gain rather than ideology has become the motivating force among students abroad who would be willing to sacrifice national interests for their own individual interests. There is a further concern that liberalized attitudes are conducive to increased professional opportunities but that these attitudes have also led to unrealistic expectations by Chinese students abroad.

If appropriate changes were made the students would be more likely to return home. These changes would include : (1) respecting knowledge and increasing the status of educated professionals, (2) providing funds to research institutes, universities and institutes, and (3) removing obstacles to promotion for returned graduates. Until these incentives are clearly in place Chinese students abroad are likely to continue to delay their return. The PRC needs to create a favorable climate to attract and retain student graduates from abroad.

Are Taiwan ROC students abroad like PRC students?

In an National Science Foundation grant (INT 8822205) studying the reentry adjustment of Chinese students from the Republic of China Pedersen et. al. (1991) discovered several patterns that might apply to Chinese students from the PRC as well.

Students were more likely to return if : (1) they were not in technical and hard science fields, (2) they were funded by the government rather than private sources and (3) they were older, married and/or had jobs waiting for them back home.

Psychological factors favoring return home included : (1) a sense of belonging in Taiwan, (2) a low level of expressed " well being " in the U.S., (3) a high level of loyalty to their family in Taiwan and (4) a " sense of responsibility " for Taiwan.

Professional incentives favoring reentry included : (1) having a job waiting back home, (2) perceived " career possibilities " in Taiwan exceeding possibilities in the U.S. and (3) the availability of an infrastructure in Taiwan to enhance personal growth.

Nonspecific factors favoring reentry included : (1) the importance of family loyalty, (2) a positive assessment of the environment and degree of pollution in Taiwan (3) a favorable perception of the political environment in Taiwan and (4) the opportunity to make a meaningful contribution in Taiwan.

The reentry decision changed over time based on : (1) the changing strength of personal and professional support, (2) changes in philosophical and ideological orientation and (3) changes in advice from the family in Taiwan. These data provide insight into the decision making process of whether or not to return that perhaps applies to students from Taiwan and students from the PRC as well.

First, satisfaction with the living and working environment is an important factor in promoting a successful reentry for some students but not for others. It seems that personal and professional attraction by itself is not a good predictor of successful reentry for Chinese students. This would contradict the stereotyped presumption that students would remain abroad to protect their private self interests.

Second, returnees expect some extrinsic rewards beyond knowledge alone when they go abroad to study. Some of these rewards include enhanced worth of the degree, a good career, practical experience in a specialized field, prestige of study abroad and respect from society.

Third, ideological reasons are extremely important in determining successful reentry. Most returnees say they returned because of patriotism, obligations to family, feelings of strangeness or discrimination abroad, potential contributions to their profession or family influence. Fears that the new liberalism in the PRC will erode the student's loyalty do not seem justified by these data. Loyalty to the family and to China is a profoundly important factor for deciding to return home for ROC students studying abroad.

Fourth, the external influence of family friends and the environment are extremely important. Those returnees who were more internally oriented were more likely to stay home permanently after their original return home than those influenced by " powerful others " or externally oriented. It may be that the very students identified now as " trouble makers " abroad are the ones most highly motivated to return home, given the right opportunity, while the more conformist and compliant students are more likely to remain abroad.

Fifth, other research on reentry relates return rates to economic development back home, employment opportunities, the extent of social support, the source of sponsorship (public or private) and other circumstantial factors. In some specialized areas there may not be opportunities for graduates to return home.

They may better serve China by remaining abroad and enhancing their expertise for return at some future time when the opportunity arises. Chinese students abroad are like a bank account of talent for China, which accumulates interest in the form of increased expertise and from which the PRC and ROC can make withdrawals at some future time as appropriate.

What are the misattributions about reentry ?

Several examples of misattribution seem evident from the data available.

First misattribution : "Students from abroad are motivated to remain in the U.S. after graduation primarily for financial reasons." While foreign students in science and engineering want and expect a minimum level of security and well being back home, ideological, belief-based and family loyalty factors were much more influential than financial factors in the decision..

Second misattribution : "It is clearly in the best interests of the U.S. that the best and brightest foreign student graduates in science and engineering should remain permanently in the U.S. after graduation." Graduates who return home intend to contribute to their professional and regional best interests by maintaining a network of scientists and engineers from the U.S. in ways that are important and perhaps essential to science and technology in the U.S.

Third misattribution : "Returned graduates in science and engineering will be a destabilizing factor back home because of their foreign attitudes and opinions." Students have no doubt been changed by their stay in the U.S. but their consistent attitudes are to make a contribution to progress and national development back home and there is a consistent emphasis on cultural and national loyalty to the back home country in the data available.

Fourth misattribution : "Whatever is to the advantage of the sending country is almost certainly not in the best interests of the receiving country." This zero-sum assumption places the student in an impossible position of having to choose between the home and host country rather than work toward a win-win outcome which would be in the best interest of both countries.

Fifth misattribution : "Foreign student graduates would prefer to stay in the U.S. if they were given the opportunity." Even those foreign student graduates who end up staying in the U.S. often do so reluctantly and expect ultimately to return home after some delay when the conditions favor their return home.

Sixth misattribution : "There is nothing that the home country can do that will influence foreign student graduates to return home after study abroad." Countries that actively seek and maintain contact with their students during the period of study and who seek to create favorable conditions for the return of individual students have a relatively high return rate over time.

Seventh misattribution : "Most students who decide to remain in the U.S. after graduation are from less industrialized countries while students from more industrialized countries are more likely to return home." While the students are more likely to return home if there are opportunities available for them there, there is no clear evidence that links levels of industrialization with return rates.

Eighth misattribution : "If the student graduates do not return home immediately they should be counted statistically as contributing to the brain drain and will probably never return home later." The brain drain construct presumes the permanent and one-directional loss of talent from sending countries to receiving countries.

Ninth misattribution : "Brain drain is the deliberate exploitation of less industrialized home countries by the more industrialized host countries." When the student decides to stay, the sending country may be " drained " of that student's potential contribution but every student who decides to return home brings what they learned with them and thereby " drains " some of the technology of the receiving country in a reciprocal exchange.

Tenth misattribution : "Graduates who return home will be given the opportunity to make a contribution from their learning." Graduates who have returned, report that they are often hampered in making a contribution by jealous colleagues, political suspicion, administrative rigidity or other institutional barriers that sabotage the graduate's ability to contribute in meaningful ways from what they have learned abroad.

Conclusion

Countries with higher rates of delayed return have frequently experienced rapid development while countries with a lower rate of return have developed more slowly. Other literature points out positive benefits of talent migration (Glaser, 1978). Migration channels excess manpower to countries where it can be utilized, facilitates the transfer of technology, enhances the production of educational knowledge, strengthens ties between countries, provides income remittances to home countries and benefits to the individual migrants (Buck, 1980).

This chapter has explored patterns of data about reentry that suggest both the alternatives of returning back home permanently or staying in the host country permanently are problematical for the sending country, the receiving country and the individual student. The implications of these data are that a third alternative exists providing the graduate with the freedom and opportunity to go "back-and-forth" between their home country and their professional community of colleagues abroad. Instead of competing for the student graduates in a zero-sum tug of war between sending and receiving countries, the back-and-forth alternative would allow everyone to benefit from the graduate as a fluid resource linking professional communities in both the sending and receiving countries.

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Reversal of Korean Brain Drain: 1960s - 1980s

Hahzoong Song

Introduction

Recent years has seen a large influx into Korea of U.S. trained Korean scientists and engineers. Data show that more than three quarters of Korean scientists and engineers who earned PhDs in the U.S. in the 1980s have returned to Korea within three years after graduation. Since the US is the major destination of Korean students for graduate works abroad, Korea has come to enjoy a 'reverse brain-drain' or 'brain-gain' - an inflow of high-quality human resources. Now at an important juncture in its course of development, Korea needs technological sophistication to maintain the momentum of further progress. And a corps of scientists and engineers who were educated and trained in advanced countries constitute an invaluable source to this end. Their contributions in education, research and development areas are also significant.

During the brain-drain controversy of the 1960s, some analysts believed that social and economic incentives would drive talented people out from developing countries for advanced countries. Given resource shortages of then developing countries, this problem seemed unlikely to be solved soon. Today, many third world countries still lose their best talents to advanced countries. The case of Korea, however, exhibits that once a brain-drain curse might turn into a blessing. Taiwan also experiences a similar rush of returning expatriates. This phenomenon can be attributed primarily to the booming economy in both countries.

But, it goes beyond economy : brains are returning despite their countries are still relatively weak in the economic structures and living conditions compared to advanced countries. Psychological and emotional factors are also identified to play an important role, once economic conditions of the country reach a certain level. It is in this regard that government policies may be a help for some developing countries to increase the number of returning expatriates. For those countries, policies to utilize the repatriated talents should be carefully designed and implemented.

This paper examines the experience of Korea : from brain-drain to reverse brain-drain over a three-decade period (1960-1988). Although the Korean case is rather an exception than the rule, it should shed light on the issue and policy directions for other developing countries. This paper consists of two parts. The first part examines the changing trends in the residence choice of Korean scientists and engineers (hereinafter KSEs). Factors to affect individual's residence choice are analyzed. The analysis is based on a survey of two groups of Korean scientists and engineers : those who decided to stay in America, and those who have returned to Korea. The second part describes government policies of Korea to cope with the brain drain problems in the 1960s through 1980s.

Residence Choice of Korean Scientists and Engineers [1]

Korean students in America

The number of Korean students going abroad for higher education increased sharply in the 1980s. While the increase was backed by strong economic performances of the country, it was attributed mainly to the changes in Korean government's policies on study abroad. Throughout the 1960s, Korean government maintained highly restrictive policies on allowing students to study abroad. Minor changes were made in the regulation of study abroad during the late 1970s, followed by a major liberalization in 1981.

As Table 1 shows, Korea's liberalization of the rules governing studies in foreign countries was followed by large increases in the number of Korean students in America in the 1980s. The number of Koreans receiving U.S. PhDs also increased rapidly. In 1993, there were a total of 31,080 Korean students enrolled in U.S. institutions and 1,118 received science and engineering PhD degrees.

Table 1. Korean students and PhD recipients in America, 1960-87

Years	Korean students in America	Korean PhD recipients in nat sci and engineering for the year*
1960	2,310	28
1965	2,666	66
1970	3,857	107
1975	3,260	105
1980	6,150	87
1981	8,070	104
1982	11,360	123
1983	13,860	183
1984	16,430	204
1985	18,660	251
1986	19,940	309
1987	20,520	450

* For years prior to 1980, the number shown is the average for the five years following the years in question (e.g., 1960-1964 for 1960).

Source : Institute of International Education, New York, Open Doors, 1960-88. National Science Foundation.

Changing trend in KSEs' residence choice

Survey results show that the prevailing residence choice of KSEs has shifted from America to Korea over the last three decades. Most KSEs who received PhDs in the 1960s chose to stay in America, with less than 20 % of them returning to Korea as of 1987. In contrast, about two-thirds of KSEs who received their PhDs in the 1980s returned to Korea by 1987. A substantial proportion of the PhDs of the 1980s returned after a short stay in America, mainly under post-doctoral appointments. Table 2 shows this trend.

When KSEs first arrived in America, a majority of them expected to return to Korea after receiving their PhDs. A higher proportion of the 1960s PhDs changed their minds and stayed in America, whereas a smaller proportion of the 1980s PhDs changed their minds.

Table 2. Changing trend in KSEs' residence choice of 790 survey respondents

PhD year	Total number	Stay in USA	Return to Korea	
			Just After PhD	After work in USA
Before 1970	118	83.90%	3.40%	12.70%
1970-79	276	67.80%	10.10%	22.10%
1980-87	396	31.60%	39.40%	29.10%
Total	790	411	188	191

Factors to affect individual KSE's choice

Over the thirty-year span, no significant differences existed in the personal conditions and perceptions of the KSEs when they first came to America. The backgrounds of the KSEs who received PhDs in the 1960s are similar to that of the KSEs who received PhDs in the 1980s when they first came to America : their average age was about 27 ; 52 % was single ; 86 % came to America as students ; 62 % had worked in Korea for four years on average before coming to America ; and more than 60 % intended to return to Korea upon receiving degrees. However, their experience and changes in personal situations during and after graduate work seem to have played a major role in their residence decisions. Aside from changes in personal situations, the most important factor to affect KSEs'choice appeared to be the difference of economic conditions between America and Korea at the time of making decisions.

But with the improvement of Korea's economic conditions, as was the case in the 1980s, the value framework stemming from cultural differences of the two countries became more apparent as a determinant of return-rate. A high prestige attached to teaching jobs in Korea is a major factor to influence KSEs'decisions. Under the Confucian hierarchical value structure of Korean society, teaching jobs have traditionally carried a very high level of prestige and, thus, a most preferred occupation of an educated elite. Whether the KSEs have major family related responsibilities (either in Korea or America) appear to be another critical decision factor.

Job and career

When KSEs receive the PhD, their need for training/experience and desire for accomplishment are the primary reason for staying in America. Also if KSEs find good jobs in America, they are more likely to stay. If they have been sent by Korean organizations, especially educational institutions, their obligations seem to prompt their immediate return.

While the need for experience naturally decreases as they stay longer, many KSEs in America find that the opportunity for career growth in their present jobs is lower than they originally expected, and they expect better career prospects if they return to Korea. However, a majority of them express difficulties in finding desirable jobs in Korea. This is reflected in their identification of having a good job in America as a major reason for staying in America. More than half of the KSEs in America are willing to accept Korean jobs, if they are their preferred ones, mostly teaching jobs. A slightly lower but still substantial proportion of KSEs in America responded favorably to accepting temporary Korean jobs.

Among the KSEs who worked in America after their PhDs, more KSEs returned to Korea when they felt their further career development was blocked. Although their self-evaluation of accomplishment in America did not differ from that of KSEs in America, more KSEs who returned to Korea than KSEs who stayed in America report that they felt that their career prospects in America were unfavorable. In addition, race or national origin was more commonly identified as a serious disadvantage by KSEs who returned to Korea than those in America.

Among KSEs who returned to Korea, a significant pattern of job change is observed in favor of teaching jobs. A high proportion of KSEs in Korea with teaching jobs (84 percent) do not want to change their jobs. On the other hand, corporate research jobs that have the opposite characteristics of teaching jobs have more defectors than other jobs. Social prestige and job security are strong points of teaching jobs, while corporate research jobs are paid higher (about 50 percent more than teaching jobs) but have less security and much less social prestige or honor. The same preference for teaching jobs and their merits are identified by KSEs in America in describing their preferred jobs in Korea.

KSEs'reported income in America in 1988 was two to three times more than that in Korea. Since their reported income in America was ten times larger than that of Koreans in 1960, KSEs' income in Korea has improved considerably over the three decades. Differences in prevailing salaries for an individual's present job in America and Korea do not appear to be a major factor in KSEs'residence choice. Besides differently identified job characteristics among Korean jobs, other personal considerations seem to offset the income difference between the two countries.

While KSEs in America reported diverse job types and work activities, more than 90 percent of KSEs in Korea are engaged in teaching and R & D jobs. Private companies'recruitment of KSEs is gaining in recent years, with higher income as the major attraction.

Family, personal situation and children's education

KSEs in America regard their family situation as another major reason to stay in America. However, for KSEs who returned to Korea, rejoining family and friends in Korea was a major motivation for their return. Because most KSEs in Korea lived in America for a relatively short period, their concerns about family in Korea (e.g., parents) are serious considerations. When KSEs stay longer, family's adjustment and assimilation to American lives are likely to make them shift their family concerns from Korea to America.

This family situation of KSEs who stayed longer is especially represented by the problem of children's Korean language proficiency. In particular, when KSEs'children are of middle school or high school age (11 to 18), the problem of their Korean language ability is a serious concern in KSEs'return decision. About one-third of KSEs in America would expect their children to have serious adjustment difficulties if they returned to Korea. A high proportion of KSEs who actually returned to Korea in spite of their children'Korean language problem want their children to live in America.

Few KSEs are female. This reflects the bias of Korean society that discourages women from pursuing professional careers in science and engineering. Surprisingly, there is no significant difference in residence choice among eldest sons. As eldest sons are primarily responsible for taking care of their parents and family, we expected more eldest sons to return to Korea.

KSEs spent on average five years for their PhD work and received degrees at the median age of 32. Reflecting the increasing tendency for recent graduates to return, KSEs in America are seven years older on average than those in Korea. There is no noticeable difference in the quality of KSEs'PhD awarding institutions between KSEs in America and Korea.

KSEs finance their graduate study mainly through university-related support. In recent years, more KSEs have received financial support from Korea. If they are financially supported by Korean institutions, they are more likely to return to Korea.

Many KSEs who came to America as students changed their immigration status to permanent residents over the PhD work period, and they are likely to stay in America. This tendency is stronger among KSEs who married during their graduate work period.

Perception and attitude

Both groups of KSEs, in America and Korea, evaluated America more favorably than Korea in various aspects : work attitude, education system, trustworthiness of people, fair evaluation of job performance, work environment, and resources for work. However, they agree that Korean " personal relationships " are better, while each group favors the way of life of their present residence. This implies that KSEs preserve their intrinsic emotional framework regardless of their assimilation to American lives.

Both groups of KSEs expressed a belief in American dominance as a political power in the world and a leader in science and engineering. They are doubtful, however, about the future improvement of the American economy and social situation. Prospects for improvement in the Korean social situation have received a mixed review ; KSEs in Korea have a considerably more positive attitude than KSEs in America have. Both groups are strongly optimistic that economic and political development of Korea will continue in the next ten years. Although Korean science and engineering is not expected to be a major contender for world leadership, a small but significant proportion of KSEs think Korea has the potential to be a major player at the world level. They take a reserved position as to the possibility of Japanese emergence as a new leader in science and engineering.

KSEs in America generally view their friends in Korea as satisfied with their return, and evaluate their friends' accomplishments in Korea more favorably than KSEs in Korea evaluate themselves. By contrast, a lower proportion of KSEs in Korea think that their friends in America are satisfied with their lives in America.

In recent years, many KSEs in America have visited Korea to see their family or friends or do business. Before they returned, most KSEs maintained contacts with their friends in Korea. As a group, the KSEs remaining in America do not maintain as much contact their friends in Korea as the returnees did. The information KSEs in America have about Korea is mostly acquired from American sources.

Simulated probability assessment of factors on KSEs'residence choice [2]

Simulated probabilities of KSEs' return to Korea exhibit a significant role of economic situations. At the time of the reception of PhDs, the probabilities of KSEs'return to Korea were quite low : 1 % for 1963 condition (Korea's per capita GNP was 5 % of America's) and 19 % for 1983 condition (Korea's per capita GNP was 12 % of America's). But, three years after they received PhDs, the probabilities of the two groups of KSEs' return to Korea differed greatly : only 7 % among the 1963 PhDs, and 47 % among the 1983 PhDs. This contrast seems to indicate the effect on KSEs'choices of changing economic conditions of Korea.

Korea's poor economic condition during the 1960s might have forced most KSEs to stay in America after they earned PhDs. Moreover, KSEs who decided to stay temporarily in America might have found it difficult to return to Korea after the originally intended stay : they either changed their minds or expected to remain in America for a long time. Among those who received their PhDs in recent years and decided to stay temporarily in America, however, there is a growing tendency that they would return only after a short period of time. Although most KSEs do not return home immediately after their PhD awards, the improvement of Korea's situation seems to work against an extended stay in America.

The effects of personal conditions are different, depending on the economic situations of the decision time. At the time of PhD awards, job availability and concern for career development made 14 % difference in the probability of return to Korea for 1963 cohorts, but 58 % for 1983 cohorts. The KSEs who perceived some kinds of obligation to their home country and regar-

ded lifestyle an important aspect in their lives were more likely to return to Korea : by 7 % among the 1963 cohorts, and 37 % among the 1983 cohorts. Whether the KSEs strongly identified personal or family matters in Korea made 2 % difference for 1963 cohorts, and 22 % for 1983 cohorts. Other personal attributes showed similar patterns of differences between the two cohorts of 1963 and 1983. These results and analyses at other decision points exhibit two major points in explaining KSEs' choice behavior. First, when KSEs receive their PhDs, economic conditions and career-related concerns are main factors to affect their residence choices. In fact, Korea's poor economy in the 1960s was a dominant inducement of KSEs'stay in America. Second, as Korea's economy achieved substantial improvements, KSEs'choices are significantly affected by their personal characteristics or perceptions.

Government policies: underlying assumptions and policy leverages

Maximize benefit generated by KSEs in Korea: Korean policies in earlier period

The innovation and improvement of production are mostly carried out by those with formal education. Therefore, training and education is an indispensable factor to enhance the capacity of those talented human beings. Government policies in the 1960s and 1970s were directed to " repatriate as many KSEs as possible in the earlier period of their careers. " Government devised and applied various incentives to this end. But, they were effective only in a limited sense.

One of the measures taken by Korean government to counter the brain drain was to provide financial supports to KSEs. From 1968, Korean government supported moving expenses for those KSEs who were about to return to Korea and living costs for temporary visitors. Even though these financial incentives were helpful to KSEs, they failed to significantly affect the KSEs'residence choice itself : Most KSEs who temporarily visited Korea returned to America just after their stints. Another measure taken by Korean government against brain drain was to provide strings-attached financial aids to those going abroad for studies. But that obligation was occasionally disregarded by the aid-recipients. Lack of effectiveness of the past incentives cannot be attributed to the Korean government's ineptness. Rather, the reason must be traced to a fundamental problem — their reluctance to return to then economically unpreferable Korea. Facing this situation, all what Korean government could effectively do at that time was to impose rather stringent qualification requirements for Korean students to go abroad.

Value of not having all KSEs return: policy direction in the 1980s and on

If Korea's economy maintains its current pace of expansion, the gap with American economy will be steadily narrowed. In addition, if the present momentum of Korea's political development sustains, the proportion of KSEs who intend to return to Korea should grow. In spite of this favorable trends, however, some KSEs will still prefer to remain in America for a variety of reasons : some may find it better to stay in America for professional career development ; others might like American lifestyle better ; and still some others may find it economically more prosperous to stay in America. Thus, as long as America's science and engineering sec-

tors continue to recruit foreign students, some proportion of KSEs will choose to remain in America. It is neither desirable nor realistic for all Korean students to return immediately upon completion of their degrees. Since the pro-stay KSEs can serve as a well-placed channel to funnel the advances of American science and technology to Korea, they can be considered an important component of Korea's overall scientific and technological development.

The reversal of the trend in the 1980s suggests both the increasing leverage of government incentives and the importance of government role in " controlling " the flow. The investigation indicates that KSEs' choices are no longer dominated by economic matters alone. Their choices are also affected by numerous other concerns, including family, personal compatibility, and career prospects. Some of these concerns are susceptible to policy incentives. Thus, Korean government at this point has important leverages to control KSEs'decisions. From mid-1980s and on, Korean government policies over KSEs has been changing under this line of logic : scout the most needed among experienced KSEs and let the remainder decide by themselves.

Giving emphasis on temporary visitors

In 1990, the program to support the moving expenses for returning KSEs ended. It was recognized that travel expenses did not work as a significant factor in residence decisions. On the contrary, the policy to support living expenses for temporary visitors was expanded. This policy applies not only to prominent KSEs but also to foreigners, expecting their contribution in international cooperation of R & D activities.

Introduction of " Brain Pool "

In 1994, Korean government introduced so-called " Brain Pool " program. This program is aimed at enabling local universities and government sponsored research institutes to hire overseas trained KSEs for a short stint. Invited KSEs, funded by government, are supposed to teach or engage in R & D for one year and may renew the contract up to three years. These temporary positions are intended for mid-career scholars with research or teaching experiences (presumably more than five years). During their stay in Korea, they have opportunities to experience Korean situations and may seek permanent appointments.

Allowing research institutes to establish independent graduate schools

Beginning 1997, government-funded research institutes will be allowed to establish their own education branches (at graduate level). Surveys show that most KSEs prefer domestic university positions to that of private companies or research institutions. In fact, each year a substantial proportion of the KSEs who have appointments with research institutes, public or private, quit to take university positions. They certainly choose high prestige and social status attached to professorship over better economic incentives of private sector jobs. The market mechanism and changing public perception may eventually cure this imbalance — but only after a considerable period of time. Education branch of research institutes will give KSEs the title of a professor and researcher at the same time. This will help KSEs enjoy both the prestige of professorship and the opportunity for career development in research.

Post doctoral appointment for junior KSEs

Korean institutions are encouraged to offer post-doctoral appointment to the KSEs who want a job in Korea. While enhancing their competency, KSEs under this arrangement are believed to have better chances to find permanent positions. The policy also includes measures to support overseas post-doctoral appointments for the KSEs who received PhDs in Korea. These measures are believed to be helpful in building up a ground for international exchange and cooperation among junior scientists and engineers.

Helping KSEs organizations' activities and networking

Korean government is reinforcing the support for Korean scientists and engineers'organizations abroad. Certain activities of associations in America, Japan, and Europe are sponsored by Korean government. It was found that the KSEs who maintained good contacts with Korea were more likely to return to Korea. A useful information channel have been effectively constructed through these professional organizations. Database collected through these organizations serves to connect domestic demand and the KSEs with the needed expertise. These organizations also disperse information about Korea's progress in the members'fields as well as general changes in the country's situation. More complete information about Korea will help KSEs make choices properly by removing sources of misjudgment and bias. An established channel also enables Korean industry or academia to keep track of experts in various fields and to recruit them when specific needs arise.

Policy shift over three decades

As indicated by the fact that the above mentioned policies were introduced mostly in the 1990s, it was not until recently when Korean government's shift on the position regarding brain drain has become a reality. Even though the need for change was recognized during the 1980s, government took time in implementing specific policy measures. New policies are basically designed to help KSEs decide by themselves, but let them have enough information and chance for choice. This line of policies are based on somewhat different ideas from that of the 1960s, i.e., that of nationalist's. While nationalist's view is supported by the countries suffering from brain drain, Korea's new policies may have been formulated encompassing the reverse brain drain phenomenon.

Concluding remarks

It should be noted once again that economic factors are central to the understanding of the brain drain phenomenon. Differences in the structure and level of economy between host and home countries are the initial point of the problem. In the case of several newly industrialized countries (NICs), the return of expatriate scientists and engineers seems to be due in large part to the establishment of science and engineering infrastructure, accompanied by substantial progress in their economies. But given the fact that, even though there still exist substantial discrepancies in living standards and social infrastructure between advanced countries and NICs, a large proportion of overseas-trained brains return to their home countries, the effect of noneconomic factors cannot be ignored. It must be stressed that cultural background that shapes the frame of reference was found to be particularly important an aspect in KSEs'choices.

Both traditional brain drain and the unanticipated return of long-time expatriates ("reverse brain drain ") pose some complex policy issues. Although developing countries are trying to retrieve the talent educated abroad, it is difficult for these countries to ensure proper jobs for returning expatriates. Instead of focusing simply on potential losses of the talent, discussions of brain drain must consider another aspect of the issue : how to optimize the expertise of available human resources to meet the goals of national advancement. To the extent that policies are designed to maximize the number of returning students, they must rely on incentives rather than command-and-control approaches. As we saw in the Korean experience in the 1960s, however, incentives are effective only in a limited sense. It will not be until overall economic

conditions of the country reach a certain level — not necessarily equivalent to that of advanced countries — when well designed incentives may work as useful policy leverages. It is from that point on when policies reflecting country-specific aspects (culture, lifestyle, family relations, etc.) may begin to work effectively. In order to be able to design such policies, a comprehensive investigation should be conducted on related matters.

The Korean case shows a significant role of culture specific aspect in KSEs'decisions. This may be the case in the countries with similar cultural background, e. g., Far Eastern countries. Many students-turned-immigrants from Asia assumed professional jobs in America over the last three decades, constituting a substantial portion of foreign scientists and engineers in America currently. Despite their stable social and economic status, their assimilation into the American society and their attitudes toward their native countries seem to differ significantly from those of European immigrants. Because many aspects of the underlying orientation of KSEs will not be much different from other Asian scientists and engineers (especially those from Confucian influenced countries), the findings from this study should be pertinent to them.

A particularly relevant group to which we can apply the findings in this study is Chinese students in America. Presently, the number of Chinese students in America are far greater than those from most other countries (44,380 in 1994). Many Chinese students who earned their doctoral degrees express their intention to stay in America. They face a comparable dilemma to that of KSEs in the 1960s and 1970s. Although they want to return to China, poor living standard and inappropriate work environment in China lead many Chinese students to stay in America. In addition, political concerns seem to make them choose to stay in America. Their comparison of option would involve many aspects that are identified in KSEs'decisions in earlier years. If so, the Chinese government could utilize information from the present study in establishing incentives to repatriate their students back home.

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[1] Data presented here are obtained through a survey conducted by myself. Samples were drawn from a population of 3,242 U.S. trained Korean scientists and engineers (KSEs)-those who identify themselves as a Korean or being of Korean-origin, earned their PhDs in the U.S. in the fields of natural sciences and engineering between 1960 and 1987. According to US National Science Foundation data, there were 3,242 such Koreans. At the time of the survey (1988), 1,545 of them were identified living in America and 1,411 in Korea. I distributed through mail 998 questionnaires in America and 983 in Korea. Among them, 432 and 406 questionnaires were returned. I personally interviewed 87 KSEs to supplement the mail survey. While the survey data provide information on individual KSE's family situation, job and career, and perception and attitude, indicators of the external situation (economic, social, and political) on America and Korea are taken from published statistics. I analyzed the collected data adopting several complementary approaches — descriptive comparison of KSEs who returned to Korea and stayed in America, analysis of an observed discrepancy between intention and action, and discrete choice analysis

[2] To assess the effect of each factor on the residence choice of KSEs, I performed a discrete choice analysis using maximum likelihood estimation. I assumed that KSEs'choice depended upon both personal conditions and external situations. Indicators for external conditions were selected to represent the political-economic conditions, and science and technology activities of both Korea and America. Most variables on personal characteristics were constructed using KSEs'responses to survey questionnaires. I ran probit regressions for KSEs' choices at the time of KSEs'reception of PhD, and three years after receiving PhDs.

The Diaspora Option

Part 6

Tunisian Expert Aboard: a Greater Contribution to National Development

Belgacem Henchi

Brain drain or migration of experts, exodus or exile happens when a “ community loses its intellectual human resources to the advantage of another ”. There can be other types of losses such as muscle drain (athletes), labor drain (blue collar workers) or talent drain (artists). Missionaries working with organized cooperation are not taken into account because, although-being a provisional “ loss ”, they follow State policies. Stays abroad for studies or assistant-ships are not taken into account either, nor are institutional personnel exchanges.

The population of “ Exiled experts ” has its dynamic character with its own growth laws. It depends, first, on the general context of the country of origin (socio-political and economic situation) ; then, particularly, on the development of science and, last, on the extent migrants have settled down in the host country.

1. The universal character of science and technology makes intellectuals, in general, and scien-tists, in particular, think that they can emigrate any time to places where, as they are useful to the greatest possible extent, they can feel achievement. It has clearly been determined that, except for medical professions, scientists rarely leave their countries due to financial reasons. Most of the time they do it because of :

- isolation ;
- lack of specialists colleagues with whom they can exchange ideas ;
- lack of infrastructure, literature and reception structures.

These reasons are usually linked to the lack of resources, but also to the absence of a critical mass of experts in increasingly diverse fields of knowledge.

2. Furthermore, for an expert it is essential to see, at the end of the chain, the result of his effort and to obtain recognition and honor. Besides, for a production apparatus, in order to achieve and maintain competitive performances, it is also essential to know how to draw and to keep the generosity of the creators of such performances. A good understanding of this intersection of mutual interests seems to be the main source of satisfaction for both. The feeling of being part of a successful process, gives a sense of responsibility and sharpens creativity. Additionally, it encourages integration of everybody, regardless of the creed or the political ten-dency, in the construction of development.

All these conditions are absent in our country, as they are in all Southern countries, and, as a result, virtually all our national experts are becoming exiles from a system that takes very little advantage of their potentialities.

International context. A bad souvenir for the North

Europe has suffered from a massive brain transfer, particularly during and after the World Wars, to the advantage of the new world, that is North America. As Lord Bowden (UK) stated, “ If we capitalized what are worth those who, since the war, have left the British Isles to go to America,

we would have paid, by far, the Marshall plan ". Today, this hemorrhage is nothing but a bad memory and despite the fact that brain mobility between Northern countries still exists and is even encouraged by international competition, it does not affect any more this countries'" Strategic Reserves "; they have, indeed, a number of engineers and scientists per million of inhabitants 15 to 20 times greater than the number in the developing countries have (table 1).

It is true that some Northern countries have an important migratory flow of top-level migrants, to the advantage of more powerful neighbors; nevertheless, they are not excessively affected due to the compensatory flow of immigrants (from the South and elsewhere) of the same quality, whose transfer and settling down are practically organized by the host country. It could be useful to mention the example of Canada; only in the province of Quebec, 34 % of all university teachers are foreigners and in the whole country the rate mounts to 45 %; Canada spends an average of Canadian $ 250.000 to train a teacher; once he is operational, he generates 20 highly-qualified jobs (hence highly well paid). This is a clear example of the extent of the loss of one of these groups and the gain of the other (operational teachers and establishment of highly technical jobs).

Table 1. Average expenses in R&D (% GNP) and number of scientists and enginners, per millon of inhabitants

	R&D %GNP	**S&E/MILLION of inhbts**
Industrialized countries	2.48	2 792
USA	2.8	3 233
Japan	2.8	4 836
European countries	2.04(9)*	1 111 (19)*
France	2.3	1 888
Former FRG	2.7	2 382
Sweden	3	2 537
England	2.3	no data
Israel	3.7	4 836
Former Socialist countires	4.7(8)*	4 276 (8)*
Former USSR	5.5	5 414
Developing countries	0.46(59)*	195 (39)*

* Number of countries being considered
Source : UNESCO Statistical Yearbook 1989

A syndrome for the South

For many Asian and African countries, exile has become a massive exodus that endangers these countries'capacities to care for themselves and to train the newly arrived generations. Africa has already lost one third of its experts to the advantage of Europe. Only in 1978, 17 % of Sudan's doctors and dentists, 30 % of its engineers and 20 % of its university teachers have left the country. The situation in the Mahgreb region is not any better : the quoted rates of non return, after studies or assistantships abroad, are not really exaggerated (80 % for Tunisia and 60 % for Morocco).

This situation can only worsen in an international context where economic competition, between the winners of the cold war, for political leadership is one of the most tangible new realities. A considerable pressure is being exerted on the Knowledge and Technology market, at the disadvantage, no doubt, of Southern countries. These are all the more threatened because they do little efforts to preserve their Human Capital by offering them minimal conditions of development and work.

The Tunisian case

Evolution of the Tunisian school system

Since the education reform, undertaken in 1958, right after the independence, Tunisian school system has been placed in a dynamic and evolving perspective that follows basic principles and options :

- democratization and generalization of teaching ;
- access to development through man's progress ;
- opening towards modern culture and will to enter to the technological civilization.

The essential mission of the Ministry of National Education is to allow all children, regardless of their race, religion or social background, to have access to education and teaching. The Ministry guarantees, from the beginning, that all children will have the same opportunities both for entering the various branches of education and for fulfilling their studies, with no limit other than their own efforts and merits. As for the Ministry of Higher Education, its essential mission is, on the one hand, the training of experts whose competence is useful for the country's economic and social development and, on the other hand, the training on and through research. Access to higher education is a right that every high school graduate has in Tunisia. Selection of the branch students undertake depends both on the students'aptitudes and the country's development needs.

A study on the evolution of the education system since the independence until 1980 shows (Table 2) that primary and secondarv education have evolved more rapidly than higher education ; the latter has remained in a traditional, classical stage. Accordingly, the university's capacity to receive students remained limited and new specialties were practically absent. In order to encourage students and to guarantee a minimum of higher education in certain top-level branches, since independence and up to 1987, the State selected the best high school graduates and sent them abroad, particularly to Europe and to America (Canada and the USA) to pursue their education.Since political change in Tunisia, in 1987, there was an awareness of the problem engendered by this organized sending abroad Tunisian experts ; among the urgent measures that were taken we mention the following :

- reform of high school and university education so as to adapt one to the other ;
- training, within the country, of hundreds of specialists who were formerly trained in foreign universities ;
- granting of post graduate scholarships for those who wish to pursue their education within the country and limitation of scholarships abroad ;
- improvement of scientific equipment of specialty laboratories ;
- improving the teachers/students ratio at all levels of university education.

Table 2. Evolution of Tunisian education system since Independence (1956-1996)

	Primary education			Secondary education			Higher education		
Years	numbers of schools	Number of students	Number of primary teachers	Number of high schools teachers	Number of students	Number of high schools	Number of universities	Number of students	Number of university techers
1955/56	729	209 348	5 125	59	31 095	1 212	5	2 268	
1960/61	1108	408 758	7128	67	40 317	2 015	8	2 564	185
1970/71	2208	922 861	18 465	152	179 527	6 883	13	10 768	1 004
1980/81	2613	1 045 011	26 989	236	275 133	12 629	55	31 827	2 333
1990/91	3841	1 398 119	50 280	585	496 840	24 474	77	68 535	4 550
1995/96	4349	1 460 101	59 432	760	725 926	30 170	89	112 634	6 481

Migration of Tunisian experts

Up to 1980, a massive return of exiled experts allowed the access of Tunisians to directive-level posts ; afterwards, these returns decreased significantly, due to national limitations and to the pressure of attractive offers coming from the host countries. Among those national limitations we may mention the following :

- Tunisian's lack of information and contact with the foreign world ; in fact, up to these past years, Tunisia was disconnected from the almost unlimited mass of knowledge that circulates around the world through the networks ; thanks to the education-abroad policy, the élite of our youth was sent to the developed countries at a highly risked age (18 years). This policy was not complemented with appropriate structures to integrate the specialties being acquired (nuclear science, aeronautics, microelectronics, etc.) and to stimulate the exiles'return. The establishment of the so called Excellence establishments will not do anything but delaying these returns, since the above-mentioned structures are still absent. Furthermore, due to the inadequacy of the university recruitment system, it is impossible to expect the return of reputed experts, nor of young graduates or post graduates, since the systems or equivalencies is unfair and favors an out-of-date standard.
- Socio-economic policy : every day life is characterized by poverty of performance and scarcity of resources which are often due to disorganization and lack of management. With the pressure of this reality, priorities that are actually transitory and artificial appear. Decisions and actions are not longer based in the long term of a previously drawn strategy and do not use top-level experts' contribution ; these experts feel out of place in an economy where, in general terms, only the immediate, risk free results count.

In a parallel manner, host countries have not facilitated the return of these exiled experts ; on the contrary, they have attracted them by all means, offering them advantages even greater than those offered to their own nationals. It has been found that certain universities or research centers have done everything to retain the best exiles. They have gone as far as avoiding domestic regulations in force, concerning exile residence permits, so as to take advantage of these exiles'scientific contribution. Hence, the existence of opulent political regimes'seduction is evident and its influence in the choice of exile is subjacent.

Nevertheless, exiles are not so much attracted by democracy and human rights ; in the North countries, these seem to be sacrificed under the vital interests of their pretended defenders ; what really attracts the exiles is the tolerant, permissive society of individual freedom, a society that believes also in individuals and in their initiatives for progress.

The solutions

Since 1987's political change, before this hemorrhage of experts and its impact on the country's economy, a series of measures were taken ; they aimed at, both in the short and in the long run, establishing an infrastructure to receive exiles and an appropriate environment that allows, to the greatest possible extent, the recovering of exiled experts and the cooperation with those remaining abroad. Among these measures we can mention the following :

Institutional measures

a) Establishment of the State Secretariat for Scientific Research and Technology whose main mission is :

- development of our country's capacity to take advantage of the economic benefits of scientific and technical progress ;
- increase of national scientific potential in all fields.

b) Establishment of large schools such as the Polytechnic School and the National Institute for Applied Sciences and Technology, whose aims are to limit schooling abroad and to diminish departures from the country at a relatively critical age.

c) Development of existing Research Centers. Several Research Centers and Institutes were subjected to assessment and restructuring so as to enhance their human and material resources.

d) Establishment of specialized centers. It was found that scientific migration concerns mostly advanced technologies and highly advanced specialties. In order to limit these drains and have the country benefit from science progress, several specialized centers were founded, such as the Biotechnology Center at Sfax, the Nuclear Sciences and Technology Center, the National Teledetection Center, and the Institute for Research and Physicochemical Analysis.

Direct actions

In a parallel way to these long-term-effect measures, short-term and medium-term actions were undertaken in order to have the country profit of exiled experts. Every exile was involved in Research and Development actions in his own field and contacts between them and their homologues in our country were encouraged. Among the most significant actions we can mention the following :

Creation of databases

A bank of science and technology experts was implemented ; through this data bank the information concerning those experts is gathered in a repertory ; this allows the identification of their sectors of activity and facilitates the cooperation between them and domestic laboratories. Another data bank gathered the information concerning technical staff working in bilateral or international cooperation (Table 3) ; this has allowed a census of this executives and their classification, according to their specialty, by region, country or international or regional organization. These exported executives have the role of publicizing Tunisian know-how and hence facilitate the recruitment, in the host countries, of young Tunisian experts looking for a job abroad.

Tokten program

It is a program of knowledge transfer through the expatriated nationals. It has been designed in the framework of cooperation with PNUD. By way of this program, Tunisian expatriated experts provide a direct scientific and professional contribution to different development sectors of the country, through brief consultation not involving total participation or through implementation or organization of seminars and technical workshops. This type of transfer of technology and know-how is greatly facilitated by factors such as culture and language identity, attachment to the fatherland and will to cooperate. The Tokten program is addressed to national expatriated experts (consultants, specialists, professors and researchers) with a highly-qualified know-how and appropriated professional experience that may contribute, in different ways, to national development efforts in all sectors of development, particularly those related to science and technology.

Legal framework

The main priorities of national policy are : mastery of technology, education through and for research in different disciplines, support to applied research in priority sectors and dissemina-

tion of scientific culture within the Tunisian society. In order to achieve these goals, a global reform of the research system was undertaken in 1992 and ended in 1996 by the enactment of a law on research policy and technological development ; two articles of the law, out of 22, were dedicated to forms of cooperation with Tunisian experts abroad.

In fact, article 19, provides for special advantages for Tunisian researchers abroad when they are invited to assume a research direction or to take part in research projects of national priority. As for article 20, it encourages research and teaching institutions to invite Tunisian researchers working abroad to undertake common research projects. The law and the decrees that organize higher education go in the same direction ; in fact, they offer Tunisian researchers and teachers working abroad a series of contribution possibilities in research and higher education activities in Tunisia. For these purposes, these texts provide for different types of participation such as :

- visiting teacher-researcher (for universities) ;
- associated teacher-researcher (non university related) ;
- bilateral or multilateral cooperation agreements between resident Tunisian researchers teachers and their compatriots living abroad ;
- common tutorships of young Tunisian researchers enrolled abroad and of those working in Tunisian universities.

Furthermore, two university missions have been established abroad : one in Paris (for Europe), and the other in Montreal (for America) ; their role is to act as tutors for Tunisian experts abroad and to ensure a connection with their homologues in Tunisia in the corresponding specialties.

Courses and conferences

For some specialized branches, when Tunisian universities and research institutes lack of experts, priority is given, whenever possible, to cooperation with Tunisians abroad ; in such cases, stay expenses are figured out in an advantageous manner in relation to the number of hours taught per week, and in proportion to the salary of a full-time local professor.

Associations of Tunisian researchers living abroad

The establishment of scientific associations constitutes a framework for gathering Tunisians living abroad. This is due to the fact that these associations function, basically, on a voluntary basis and that most of Tunisians abroad enroll in them, specially in large cities where the Tunisian community is relatively well represented. Six associations have already been identified, as follows :

- 3 in the USA : Tunisian Scientific Society (TSS), Arab Scientist ans Technologists abroad, Tunisian Scientific Consortium ;
- 2 in France : Association des Chercheurs et enseignants Tunisiens en France, Association des jeunes chercheurs et universitaires Maghgrebins en France ;
- 1 in Canada : Tunisian Scientific Society.

These associations have largely contributed to a better identification of Tunisian experts working abroad. As a result of this dynamism, a consortium of associations (RSC) has been established ; it gathers researchers working in various countries and meets regularly in order to guarantee a closer cooperation.

Congress and Seminars

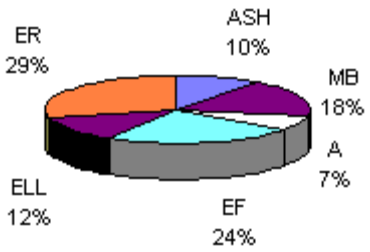
Nearly every year, most of the above-mentioned associations, in cooperation with concerned national organisms, organize meetings gathering their affiliates in the country in question. Likewise, the National Bureau of Tunisians Abroad organizes seminars and colloquiums ; the last one, held from April 19 to 20, 1996, on “ Tunisian Experts’ Contribution to the Development Process ”, gathered Tunisians coming from 11 countries (France, Italy, Switzerland, Sweden, Germany, Canada, USA, Belgium, Austria, Morocco and Mauritania).

Table 3. Tunisian Working in Cooperation Programs Abroad

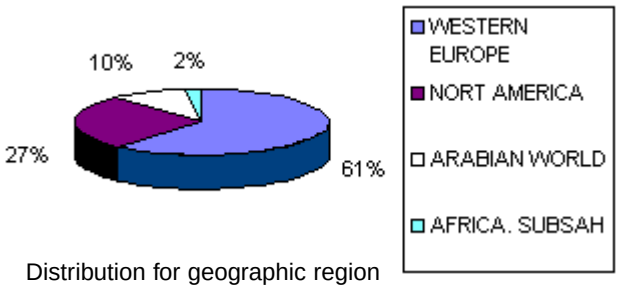
	Middle East	North Africa	African countries	International Organizations	Other countries	TOTAL
Education	2 726	100	44	28	114	2 984
Health	2 099	23	1	16	34	2 157
Administration	205	4	6	135	31	246
Transport and telecomunication	254			31	20	274
Public works	176	10	11	15	9	206
Electricity and mechanics	798	53	1	8	27	879
Agriculture	67	13	3	64	5	87
Other branches	309	3	6	40	29	347
TOTAL	**6 634**	**206**	**72**	**337**	**268**	**7 180**

Research program (the joint project program)

In the view of enhancing relations of Tunisian researchers living abroad, particularly those in USA and Canada, with their homologues in Tunisia, a program of research has been launched by the State Secretariat for Scientific Research. It aims at undertaking joint research programs by Tunisians working at institutions in different countries. This program seeks transferring advanced technology and introducing new specialties in the country so as to guarantee a minimum know-how and the local development of new branches of knowledge with little representation in the country up to the present. The program covers : engineering sciences, such as energy sciences, computing sciences, telecommunications and industry engineering ; mathematics, physics and natural sciences ; agriculture, and health. Besides, it facilitates the traveling of researchers between the two laboratories and provides for a better integration of the country in the new axes of Research and Development.



Distribution for activities



Distribution for geographic region

Conclusions

At the time of the global village, characterized by the importance of knowledge and the circulation of information, expert drain does not have the same effects on the emigration countries than it had before. It is now possible, even necessary, to take advantage of these experts, from their very country of origin, so as to achieve technology transfer, subject today to severe controls. Tunisia, a country that belongs to the Mediterranean basin, to the Arabo-muslim world and to African land has contributed throughout its history to the enrichment of universal knowledge, thanks to eminent personalities ; the great sociologist Ibn Khaldoun and the famous physician Ibn Jazzar are mere examples of successful migrations both for Tunisia and for the whole world. “ Exploitation ” of these Tunisian experts currently abroad has become even easier thanks to the Progress of communications technology. After political change in 1987, these scientific ambassadors of Tunisia are accredited by their country to work in host countries and have Tunisia take advantage of the progress engendered by their research activity.

Experts tunisiens à l'étranger : une plus grande contribution au développement national

Belgacem Henchi

Introduction

La migration, exode, exil ou fuite des cerveaux (ou compétences) se produit lorsqu'une « communauté perd ses ressources humaines intellectuelles au profit d'une autre ».

D'autres pertes peuvent inclure l'exil des muscles (athlètes), des forces de travail (cols bleus), ou des talents (artistes). Bien qu'ils constituent une « perte » provisoire, les missionnaire, de la coopération organisée ne sont pas comptabilisés puisqu'ils servent les desseins de la politique de l'État. Ne sont pas comptés non plus les séjours pour formation (études, stages) ou échanges dans un cadre institutionnel.

La population des « compétences en exil » est à caractère dynamique, possédant ses propres lois de croissance. Elle est d'abord tributaire du contexte général du pays d origine en général (socio-politique, économique) et de l'épanouissement de la science en particulier puis du degré d'enracinement dans le pays d'accueil.

a) Le caractère universel de la science et de la technologie a généré un sentiment persistant chez l'intellectuel en général et le scientifique en particulier de pouvoir émigrer à tout moment là où il aura la satisfaction d'être pleinement utile.

A cet effet, il a été clairement établi que, hormis les professions médicales, les scientifiques quittent rarement leur pays d'origine pour des raisons financières. Ils le font presque toujours à cause de :

- l'isolement ;
- l'absence des collègues spécialistes avec qui ils échangent les idées ;
- l'absence d'infrastructures, de littérature et de structures d'accueil.

Celle-ci étant généralement liée au manque de moyens mais aussi à l'absence de masse critique en experts dans des domaines de plus en plus variés de la connaissance.

b) Il est, par ailleurs, capital pour une compétence de voir le résultat de son effort apparaître en bout de chaîne puis reconnu et donc honoré. D'un autre côté, il est tout aussi capital pour un appareil de production, pour atteindre et maintenir des performances compétitives, de savoir susciter et entretenir la générosité de ses créateurs. Cette intersection d'intérêts mutuels bien compris semble être la source principale de l'épanouissement des uns et des autres. Ce sentiment de participer à une œuvre qui aboutit responsabilise et aiguise la créativité. Il favorise de même l'intégration de tous, abstraction faite des croyances ou de la couleur politique dans l'opération du développement.

c) L'absence de ces mécanismes dans notre pays, comme dans tous les pays du Sud, n'est pas loin de faire de toutes nos compétences nationales des exilés par rapports à un système qui tire très peu d'avantages de leurs potentialités.

Le contexte international

Un mauvais souvenir pour le Nord

Le transfert massif des cerveaux a touché l'Europe notamment pendant et après les deux guerres mondiales au bénéfice du Nouveau Monde : L'Amérique du Nord.

Lord Bowden (R.U.) ne déclarait-il pas que « si l'on capitalise la valeur de ceux qui ont quitté les Iles Britanniques vers l'Amérique, depuis la guerre, nous aurons beaucoup plus que payé le plan Marshall ».

Aujourd'hui, cette hémorragie n'est qu'un mauvais souvenir et même si la mobilité des cerveaux entre pays du Nord reste et est même encouragée par l'atmosphère de compétition internationale, elle n'affecte plus les « réserves stratégiques » de ces pays qui affichent un nombre d'ingénieurs et de scientifiques par million d'habitants de 15 à 20 fois plus important que celui comptabilisé pour les pays en voie de développement (tableau 1).

Tableau 1. Moyennes des dépenses en R et D (% PNB) en nombre de scientifiques et ingénieurs par millions d'habitants (Unesco Statistical Yearbook 1989)

	R et D	S et I
- Pays industrialisés	2.48	2 792
USA	2.8	3 233
Japon	2.8	4 836
Europe	2.04 (9)*	1 111 (19)*
France	2.3	1 888
(Ex-) RFA	2.7	2 382
Suède	3	2 537
Angleterre	2.3	no data
Israël	3.7	4 836
- (Ex-) Pays socialistes	4.7 (8)*	4 276 (8)*
(Ex-) URSS	5.5	5 414
- Pays en voie de développement	0.46 (59)*	195 (39)*

* Nombre de pays comptabilisés

Certains pays du Nord enregistrent certes un flux important de migrants de « haut vol » au bénéfice de voisins plus puissants ; néanmoins, il n'en souffrent pas trop vu le flux compensatoire d'immigrés (du sud et d'ailleurs) de même qualité dont le transfert et l'installation sont pratiquement organisés par l'État d'accueil. L'exemple du Canada est utile à citer. Dans la seule province du Québec 34 % de la totalité des professeurs universitaires sont des étrangers. Ils sont 45 % pour tout le Canada. Ce pays dépense 250 000 $ (canadiens) en moyenne pour former un professeur, celui-ci une fois opérationnel génère 20 emplois hautement qualifiés (et donc très bien payés). Cela ne peut qu'illustrer l'ampleur de la perte des uns au bénéfice des autres (formateurs opérationnels et génération d'emplois de haute technicité).

Un syndrome pour le Sud

Pour de nomhreux pays d'Asie et d'Afrique, l'exil s'est transformé en exode massif qui met en danger les capacités de ces pays à se prendre en charge et à former les générations de la relève. L'Afrique a déjà perdu le tiers de ses compétences au profit de l'Europe. Le Soudan, pour la seule année 1978, a vu partir 17 % de ses médecins et dentistes, 30 % de ses ingénieurs et 20 % des ses professeurs d'université. Le Maghreb arabe n'est pas en reste et les taux de non-retour, après des séjours d'études ou stages, souvent cités (80 % pour la Tunisie et 60 % pour le Maroc) ne sont pas forcément exagérés. Cette situation ne peut qu'empirer dans un contexte international où la compétition économique entre les vainqueurs de la guerre froide

pour le leadership politique est une réalité nouvelle des plus concrètes. Une pression formidable s'exerce sur le marché du savoir et de la technicité au détriment bien entendu des pays du Sud. Ces derniers sont d'autant plus menacés qu'ils font peu d'efforts pour préserver leur capital humain en lui garantissant les conditions minimales d'épanouissement et de travail.

Le cas de la Tunisie

Évolution du système éducatif tunisien

Depuis la réforme de l'enseignement de 1958 réalisée au lendemain de l'indépendance, le système éducatif tunisien reste placé dans une perspective dynamique et évolutive, qui obéit à des principes et des options fondamentales :

- démocratisation et généralisation de l'enseignement ;
- accès au développement par la promotion de l'homme ;
- ouverture sur la culture moderne et volonté d'accéder à la civilisation technologique.

Le ministère de l'Éducation nationale a pour mission essentielle de permettre à tous les enfants des deux sexes sans distinction d'ordre racial, religieux ou social, d'accéder à l'éducation et à l'enseignement. Il assure au départ, à tous les enfants l'égalité de chances tant pour leur accès aux types d'enseignement que pour le déroulement de leurs études, sans autre limite que celle de leurs efforts et de leur mérite. Quant au ministère de l'Enseignement supérieur, il a pour mission essentielle la formation des cadres pour le pays et de compétences nationales utiles pour le développement économique et social du pays et la formation par et à la recherche.

L'accès à l'enseignement supérieur en Tunisie est un droit de fait reconnu à tous les bacheliers. L'orientation des étudiants dans les différents niveaux de formation s'effectue en fonction de leur aptitude ainsi que des nécessités de développement du pays.

L'étude de l'évolution du système éducatif depuis l'indépendance jusqu'à 1980 montre (tableau 2) que l'enseignement primaire et secondaire ont évolué beaucoup plus rapidement que l'enseignement supérieur qui est resté classique et traditionnel. La capacité d'accueil des institutions universitaires était de ce fait trop limitée et la formation dans les spécialités nouvelles était quasiment absente. Pour encourager les lauréats et assurer un minimum de formation des compétences dans certains secteurs de pointe, l'État a sélectionné, jusqu'à 1987, les meilleurs bacheliers pour être formés à l'étranger, particulièrement en Europe et en Amérique (Canada et États-Unis.).

Depuis le changement politique de 1987, une réelle prise de conscience de cette fuite organisée de compétences tunisiennes vers l'étranger a été constatée et des mesures urgentes ont été prises.

Tableau 2. Évolution du système éducatif en Tunisie depuis l'indépendance (1956-1996)

	Enseignement primaire			Enseignement secondaire			Enseignement supérieur		
Années	Nombre d'écoles	Nombre d'élèves	Nombre d'instituteurs	Nombre de lycées	Nombre d'élèves	Nombre de professeurs	Nombre d'institutions universitaires	Nombre d'étudiants	Nombre d'enseignants universitaires
1955/56	729	209 348	5 125	59	31 095	1 212	5	2 268	
1960/61	1108	408 758	7128	67	40 317	2 015	8	2 564	185
1970/71	2208	922 861	18 465	152	179 527	6 883	13	10 768	1 004
1980/81	2613	1 045 011	26 989	236	275 133	12 629	55	31 827	2 333
1990/91	3841	1 398 119	50 280	585	496 840	24 474	77	68 535	4 550
1995/96	4349	1 460 101	59 432	760	725 926	30 170	89	112 634	6 481

Parmi ces mesures on note :

- l'adéquation entre l'enseignement secondaire et l'enseignement supérieur ;

- la formation sur place dans certaines spécialités assurée auparavant par les universités étrangères ;

- l'octroi de bourses de 3e cycle pour ceux qui veulent se former dans le pays et limitation des bourses nationales à l'étranger ;

- l'encouragement à l'équipement scientifique des laboratoires spécialisés ;

- l'amélioration du taux d'encadrement dans les différents niveaux de formation universitaire.

Migration des compétences tunisiennes

Cette migration a permis au début la « tunisification » des cadres qui sont revenus massivement dans le pays jusqu'en 1980 ; depuis, le retour de ces compétences s'est nettement atténué sous l'effet de contraintes nationales et la pression des offres alléchantes des pays d'accueil. Parmi les contraintes nationales, on peut citer :

- Le manque d'information et de contact du fait que le pays était jusqu'à la fin des années 1980 déconnecté de la masse quasiment illimitée de savoir qui circule à travers le monde par réseaux interposés.

- La politique de formation à l'étranger a favorisé l'envoi massif de l'élite de la jeunesse tunisienne à l'âge de tous les risques (18 ans) vers les pays développés. Cette politique n'a pas été accompagnée par la création de structures d'accueil à la mesure des spécialisations préparées (nucléaire, aéronautique, microélectronique, etc.) qui motiveraient le retour. Il est à craindre qu'à défaut de ces débouchés, la création d'établissements dits d'Excellence en Tunisie ne fera en fait que retarder l'âge des départs. Par ailleurs, l'inadaptation du système de recrutement universitaire exclut, jusqu'à maintenant, totalement le retour de spécialistes confirmés et n'encourage guère des débutants diplomés confrontés parfois à des systèmes d'équivalence injustes (doc. ing, Ph D...) qui favorisent un standard dépassé.

- La politique socio-économique : La pression d'un quotidien caractérisé par la pénurie de la performance et des moyens, provenant souvent de l'inorganisation et de la non-gestion fait apparaître des priorités souvent aussi conjoncturelles que factices. De ce fait, la décision et l'action ne s'inscrivent plus dans le long terme d'une stratégie préétablie et se passent, par conséquent, volontiers de l'apport des experts de « haut vol » tant et si bien que ces derniers, ici et ailleurs, se sentent de trop dans une économie gagnée en général par les résultats immédiats et sans risques.

- Parallèlement les pays d'accueil n'ont pas facilité le retour de ces compétences en exil, bien au contraire il les ont même attiré par tous les moyens en leur offrant des avantages qui dépassent même ceux des nationaux. En effet il a été même constaté que certaines universités ou centres de recherche ont tout fait pour que les meilleurs restent chez eux. Certains vont même jusqu'à contourner la réglementation en vigueur de leur pays pour autoriser le séjour de ces compétences exilées et bénéficier de leur apport scientifique. On constate donc que la séduction des régimes politiques de l'opulence est certaine et sous-jacente au choix de l'exil. Néanmoins, plus que la démocratie et les Droits de l'Homme qui ne semblent pas résister devant les intérêts vitaux de leurs propres promoteurs du Nord, ce serait plutôt et pour une bonne part, la société des libertés individuelles, tolérante et permissive qui attire. Celle qui croit aussi à l'individu et à ses initiatives pour le progrès.

Les remèdes

Devant cette hémorragie de compétences et son impact sur l'économie du pays, il a été décidé depuis le changement politique de 1987, une série de mesures dont l'objectif à court et à moyen termes est d'asseoir une infrastructure d'accueil et un environnement propice permettant de récupérer le maximum possible de ces compétences et collaborer avec ceux qui restent à l'étranger. Parmi ces mesures on peut citer :

Mesures institutionnelles

a) Création du secrétariat d'État à la Recherche scientifique et à la Technologie en 1991 dont la mission principale est :

- le développement de la capacité de la Tunisie à tirer profit des avantages économiques que procure le progrès scientifique et technique ;
- l'accroissement du potentiel scientifique national dans tous les domaines.

b) Création de grandes écoles comme l'École polytechnique et l'Institut national des sciences appliquées et de la technologie pour limiter la formation à l'étranger et réduire les départs du pays à un âge relativement précoce.

c) Développement des centres de recherche existants : plusieurs centres et instituts de recherche ont été soumis à l'évaluation et une restructuration a eu lieu dans le sens de renforcement des moyens humains et matériels.

d) Création de centres spécialisés : Il a été constaté que la migration scientifique concerne surtout les technologies avancées et les spécialités de pointe. Pour limiter ces fuites et faire bénéficier le pays du progrès de la science plusieurs centres spécialisés ont été créés tels que le Centre de biotechnologie à Sfax, le Centre des sciences et technologie nucléaires, le Centre national de télédétection et l'Institut de recherche et d'analyse physico-chimique.

Actions directes

Parallèlement à ces mesures dont l'effet est à long terme, des actions à court et à moyen termes ont été entreprises afin de faire profiter le pays des compétences à l'étranger en les impliquant chacune dans son domaine dans des actions de recherche-développement et surtout en développant des contacts entre compétences en exil et leurs homologues dans le pays. Parmi les actions les plus importantes :

a) Création de banques de données : une banque de compétences scientifiques et techniques a été mise en place ; elle sert à répertorier ces compétences, identifier leurs secteurs d'activité et faciliter la coopération avec les laboratoires nationaux (figures 1 et 2). Une autre banque de compétences des cadres techniques travaillant dans la coopération bilatérale ou internationale a été réalisée (tableau 3) et a permis de recenser ces cadres et de les classer selon leur secteur de spécialité par région, pays ou organisation internationale ou régionales. Le rôle de ces cadres exportés serait surtout une publicité pour le savoir-faire tunisien et permettrait de drainer d'autres recrutements dans les pays d'accueil pour de jeunes compétences tunisiennes à la recherche d'un travail.

b) Programme Tokten : c'est un programme de transfert de connaissances par l'intermédiaire de nationaux expatriés. Il est conçu dans le cadre de la coopération avec le Pnud. Il permet aux compétences tunisiennes expatriées de fournir une contribution scientifique et professionnelle

Tableau 3. Coopérants tunisiens à l'étranger

	Moyen Orient	Afrique du Nord	Pays africains	Organisations internationales	Autres pays	TOTAL
Education	2 726	100	44	28	114	2 984
Santé	2 099	23	1	16	34	2 157
Administration	205	4	6	135	31	246
Transport et télécomunication	254			31	20	274
Travaux publics	176	10	11	15	9	206
Electricité et mécanique	798	53	1	8	27	879
Agriculture	67	13	3	64	5	87
Autres domaines	309	3	6	40	29	347
TOTAL	**6 634**	**206**	**72**	**337**	**268**	**7 180**

directe dans les différents secteurs de développement du pays, sous forme de consultation de courte durée, autres que la participation, l'animation ou l'organisation de séminaires et ateliers techniques. L'identité de culture et de langue ainsi que l'attachement à la patrie et le volontariat sont des facteurs qui facilitent énormément ce genre de transfert de technologie et de savoir-faire. Les bénéficiaires du programme Tokten sont les compétences nationales expatriées (consultant et experts, professeurs et chercheurs) disposant d'un savoir-faire hautement qualifié et d'une expérience professionnelle appropriée susceptible de contribuer à l'effort de développement national sous ses différentes formes et dans tous les secteurs de développement et notamment ceux des sciences et technologies.

c) Cadre juridique : Les principales priorités de la politique nationale sont la maîtrise de la technologie, la formation par et à la recherche dans les diverses disciplines, le soutien à la recherche appliquée dans les domaines prioritaires et la diffusion de la culture scientifique au sein de la société tunisienne. Afin d'atteindre ces objectifs une réforme globale du système de recherche a été entamée depuis 1992 et a été couronnée par la promulgation au mois de janvier 1996 d'une loi d'orientation de la recherche et du développement technologique dont deux articles sur 22 au total sont réservés aux formes de coopération avec les compétences tunisiennes à l'étranger. En effet l'article 19 prévoit des avantages particuliers pour les chercheurs tunisiens à l'étranger lorsqu'ils sont invités à assurer l'encadrement de recherche ou à partici-

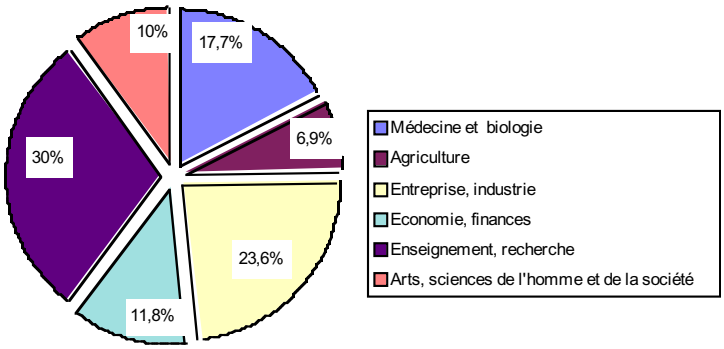


Figure 1. Répartition par domaines d'activité

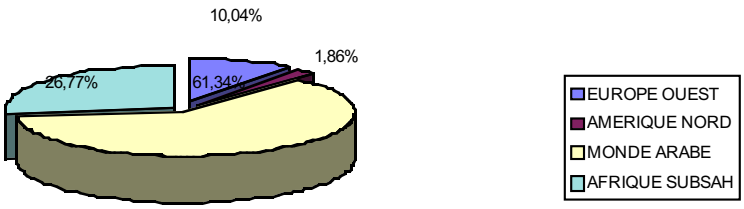


Figure 2. Répartition par zones géographiques

per à des projets de recherche entrant dans le cadre des priorités nationales. Il en est de même pour l'article 20 qui encourage les institutions de recherche et d'enseignement à inviter les chercheurs tunisiens travaillant à l'étranger pour réaliser des projets communs de recherche. I1 en est de même de la loi et les decrêts organisant l'enseignement supérieur. En effet plusieurs possibilités ont été offertes à la contribution des chercheurs et enseignants tunisiens à l'étranger à l'enseignement supérieur et à la recherche dans leur pays. En effet ces textes prévoient plusieurs formules de participation telles que :

- enseignant chercheur visiteur (pour les universités) ;
- enseignant chercheur associé (non universitaire) ;
- accords de coopération bilatérale ou multilatérale entre enseignants chercheurs tunisiens résidents et leurs compatriotes à l'étranger ;
- encadrement commun de jeunes chercheurs tunisiens inscrits à l'étranger et travaillant dans les universités tunisiennes.

Par ailleurs deux missions universitaires ont été installées l'une à Paris (pour l'Europe) et l'autre à Montréal (pour l'Amérique) et dont le rôle est d'encadrer les compétences tunisiennes à l'étranger et d'assurer la liaison avec leur homologues en Tunisie dans les spécialités correspondantes.

d) Cours et conférences : pour certaines formations spécialisées et en cas de manque de compétences dans les universités tunisiennes et les Instituts de recherche, la priorité de coopération est donnée aux Tunisiens à l'étranger lorsque cela est possible et les frais de séjour sont comptabilisés de façon avantageuse et en fonction du nombre d'heures de cours dispensées calculées sur la base du nombre d'heures enseignées par semaine et proportionnellement au salaire d'un professeur plein temps sur place.

e) Associations de chercheurs tunisiens à l'étranger : la création d'association scientifique constitue un cadre de regroupement des Tunisiens à l'étranger du fait que ces associations sont basées essentiellement sur le volontariat. La plupart des Tunisiens à l'étranger sont inscrits dans ces associations surtout ceux des grandes villes où la communauté tunisienne est relativement bien représentée.

Les associations déjà identifiées sont 6 réparties comme suit (tableau 4).

Ces Associations ont largement contribué à une meilleure identification des compétences tunisiennes à l'étranger. Suite à ce nouveau dynamisme, il a été crée un consortium (TSC) d'associations qui regroupe des chercheurs de différents pays se réunissant régulièrement pour une coopération plus étroite.

Tableau 4. Association des compétences tunisienne à l'étranger

Associations	Pays ou région	Tél. et fax
Tunisian scientific Society (TSS)	USA	Tél. : (1) 7039655312 Fax : (1) 6158709431
Arab Scientist and Technologist Abroad	USA	Tél. : 217 3333774 Fax : 217 3339819
Tunisien Scientist Consortium	USA	
Association des chercheurs et enseignants tunisiens en France	France	Tél. : (33) 0148814344 Fax : (33) 0148814344
Association des jeunes chercheurs et universitaires maghrébins en France	France	Tél. : (33) 0144856066 Fax : (33) 0142265666
Tunisian Scientific Society	Canada	Tél. : (418) 656 7777 Fax : (418) 656 7722

f) Congrès et séminaire : la plupart des associations précitées organisent presque annuellement et en collaboration avec les organismes nationaux concernés des rencontres avec leur adhérant dans le pays. D'autre part, l'Office national des Tunisiens à l'étranger organise des séminaires et colloques dont la dernière manifestation eut lieu du 19 au 20 avril 1996 sur « La contribution des compétences tunisiennes au processus de développement » et qui a regroupé des chercheurs et ingénieurs venant de 11 pays (France, Italie, Suisse, Suède, Allemagne, Canada, États-Unis, Belgique, Autriche, Maroc et Mauritanie).

g) Programme de recherche (The Joint Projet Program) : dans le cadre du renforcement des relations entre les chercheurs tunisiens à l'étranger et particulièrement ceux des États-Unis d'Amérique et du Canada et leur homologues en Tunisie, le secrétariat d'État à la Recherche scientifique et à la Technologie a lancé cette année un programme dont l'objectif est la conduite commune de projets de recherche entre des Tunisiens se trouvant dans des institutions appartenant à des pays différents. L'objectif de ce programme est le transfert de technologie avancée et l'initiation de nouvelles spécialités dans le pays afin d'asseoir un minimum de savoir-faire et d'assurer le développement sur place de ces nouveaux créneaux jusque là peu représentés dans le pays. Ce programme couvre les sciences de l'ingénieur telles que l'énergie, l'informatique, les télécommunications et l'industrie, les sciences mathématiques, physiques et naturelles, l'agriculture et la santé. Il facilite aussi le déplacement des chercheurs entre les deux laboratoires et permet une meilleure intégration du pays dans les nouveaux axes de la recherche-développement.

Conclusion

À l'époque du village planétaire caractérisé par l'importance du savoir et la circulation de l'information, la fuite des compétences n'a pas les mêmes effets qu'auparavant sur les pays d'émigration. L'utilisation à distance de ces compétences est possible voir même nécessaire pour le transfert de la technologie aujourd'hui sévèrement contrôlé. La Tunisie, pays appartenant au bassin méditerranéen, au monde arabo-musulman et à la terre d'Afrique a contribué au cours de son histoire par l'intermédiaire d'éminentes personnalités à l'enrichissement du savoir universel, le grand sociologue Ibn Khaldoun et le médecin reconnu Ibn Jazzar ne sont que des exemples de migrations scientifiques fructueuses pour la Tunisie et pour le monde entier. L'« exploitation »des compétences scientifiques Tunisiennes actuellement à l'étranger est rendue encore plus facile grâce au progrès de la technologie des communications. Ces ambassadeurs scientifiques de la Tunisie sont depuis le changement de 1987 accrédités par leur pays pour travailler dans ces pays d'accueil et faire bénéficier leur pays du progrès que procure leur activité de recherche.

Emigration of Scientists: the Uruguayan Case

Adela Pellegrino

Wanda Cabella

The notice of this meeting offers an interesting challenge to take a look at emigration in highly qualified sectors, in this particular case, of scientists. Furthermore, the organizers propose the need to restate the conceptualism of this discussion in the light of changes taking place in the modern world.

In this paper I shall refer to two aspects of the question :

First, status of the discussion on this subject in migration literature.

Secondly, I shall situate the Uruguayan case in this context, although research in this subject is very backward in the country.

Qualified Migration in the discussion on international migration

My reading is directed at literature on international migration, basically specialized journals or that included in demographic publications. It does not cover emigration of scientists in the bibliography of science sociology or statements and debates on the role of science and technology in development.

International migration is an important subject in the modern world. Nevertheless, empiric research does not attain the volume of other demographic aspects and theoretical development is relatively lagging behind other subjects such as population growth, the effects of urbanization and aging.

However, recent literature on international migration, the exodus of scientists, or more generally skilled personnel, is significantly less than analysis of mass movements of population [1].

While recent years have shown greater interest in how international migration impacts the country of origin, there is no doubt most work refers to the host country, impacts on the labor market and the insertion process for first and second generation migrants.

In the discussion on migration and development, and the north-south relationship, attention has been directed to the impact of remittance, transfer of skills, technologies and skills of returning migrants. In exchange, the selectivity of migration and its effects on the labor market in the country of origin has taken a second place.

Theoretical conjectures on the emigration of scientists at the end of the 60s and 70s referred to the controversy of the so-called “ internationalists ” and “ nationalists ”. This was the subject of a debate in the Brain Drain meeting held in Lausanne in 1967 and whose papers were published in a book by Walter Adams (1968). A number of papers were published along these lines, generally case studies handled during the following years.

The Brain Drain debate and the proposals of the non-developed countries found a certain echo in international negotiations. Organizations such as the United Nations and the International Organization for Migration dealt with " reverse transfer of technology " at international conferences and in policy-defining resolutions. Case studies on a country or regional basis were promoted, particularly at UNCTAD where interest was expressed by a series of actions aimed at including the subject in the North-South debate [2]. UNCTAD made a significant effort in this direction by undertaking an audit of human capital involved in intellectual exodus.

In the Latin American sphere, studies on emigration of skilled personnel has antecedents in many countries. In the 60s and early 70s the subject was much discussed in academic circles in Argentina. The pioneering work of Morris Horowith (1962) and Bernardo Houssay (1966) was followed by a series of studies performed by Enrique Oteiza (1965, 1966, 1967, 1969, 1971) on emigration of Argentinean professionals, technicians and skilled workers. Sito and Stuhlman (1968) and Oszlak and Caputo (1973) made a study on the emigration of doctors. As countries improved their educational systems, the subject of skilled emigration reached other countries : Uruguay (Filgueira 1976,) Chile, Colombia and, more recently Venezuela, (Pedersen 1988, Valecillos 1990, Garbi 1991) and Brazil (Aleixo, 1974) [3].

In 1971, Fernando Chaparro summarized the Latin American situation for the Organization of American States, and CELADE has made contributions in this sense : an investigation in 1982 analyzed Latin American emigration to the United States up to mid-1975 (Torrado, 1982), based on 1970 and 1980 census data. This was compiled in the IMILA data base and two reports were prepared on the mobility of professional and technicians (Martinez Pizarro 1989 and Pellegrino 1993).

The return to democracy in Argentina and Uruguay produced studies on emigrants and exiles with information on stocks of residents abroad and appraisals of qualified resources available (Lattes-Pertoncello, 1986 and Niedworok-Fortuna, 1989).

Current Status

In recent years, the advent of free trade and free circulation of capital have produced new scenarios. The acceleration of the so-called globalization process basically means internationalization of production, finance and trade, whose decision centers are no longer dominated by territory, at the same time it stresses the economic power centered in the corporations. This process blurred the nation-state notion, frontiers lost importance, and the international division of labor assumed a new shape. Progress in communications and transport have " shrunk " the world, mass media has become international and imposed western ideologies and consumer habits.

A glance at history reveals that movement of capital and spacial distribution of investments has been consistent with population migrations (Brinley Thomas, 1961 ; Saskia Sassen, 1988). Periods of free trade and free circulation of capital coincide with heavier migration.

In the current situation, the aim has been to move capital to areas where labor is cheap and plentiful, this maximizes profits for the companies and industrialized countries avoid the social costs of immigration. The possible long-term effects are being discussed : recent history has shown that it is not evident that when capital has gone in search of cheap plentiful labor, workers have forcibly stayed in their country of origin (Sassen 1988, Lima Lean Lim, 1993). Even more questionable is that this has led to local development, technological transfer and producing skilled labor.

Emigration of scientists is a specific subject within the discussion on migration and development. Various individual aspects contribute thereto : academic and research opportunities mean they are more connected to the international market. The " non-territorial " nature of the scientific community is nothing new, its universality is an intrinsic part of its existence.

The generalized use of computer technology means that residence loses importance with regard to obtaining information, working together with major centers and participating in important discussions etc.

The role of the major transnational corporations to a great extent tends to replace the migration policies of individual states, and they become the decisive elements in who migrates and where. Associating with scientific projects of leading universities in the industrialized countries has created opportunities for highly qualified engineers, technicians and managers as well as for scientists working on technological programs.

Recent literature referring to analysis of skilled and particularly highly-skilled migration, stresses circulation. The expression " brain drain " is gradually being replaced by terms such as " brain exchange " which emphasizes the mobility both to and from industrialized countries, as well as mobility between developing countries, referring to possibilities for exchange and transfer of knowledge and skills involved in this method.

The typology of international migration submitted by Appleyard (1991) includes the category of " temporary transient professionals ", covering professionals and skilled workers going from one country to another, usually as employees of international or other companies under the joint-venture system.

In the volume containing part of the papers given at a O.C.D.E. migration conference held in Rome in 1991, A.M. Findlay analyses movements of highly qualified migrants and proposed to review the concept of " brain drain " in the light of changes in recent years. Admitting that the traditional " brain drain " is maintained in those countries with selective immigration policies (United States, Canada, Australia and, more recently, Japan), the appearance of new forms of mobility and greater migration of highly qualified personnel to both developed and developing countries, has become a central element of the global economy. According to this author, the explanation is twofold : first, most non-developed countries inasfar as they tend to import capital goods designed and produced in developed countries - need to import specialists to install, maintain and service them. Secondly, the global economy is being progressively dominated by the transnational corporations for whom transferring specialized workers is imperative to assure efficient operations.

Going back to an earlier paper, John Salt (1989), the author summarizes evidence on how the " new labor division " will affect development worldwide. He upholds that exchange of highly qualified personnel within the framework of relocation by multinationals, results in minimum technology transfer for the undeveloped countries. First, because these companies are reluctant to appoint third-world nationals to top level technical and administrative positions, although this may vary between companies and countries. He concludes that the system " militates against local workers at plants in developing countries from acquiring skills and management training ".

His conclusions indicate that within the framework of greater restrictions on international migration, the mobility of highly qualified sectors has increased and this is mainly attributed to the transnational companies who have assumed the role of deciding who emigrates and under what circumstances.

In a publication of the International Union for Scientific Population Study (1992), a chapter deals with technology and science transfers and migratory flows. It refers to the scant attention this subject has attracted among policy makers and the academic world. Although this is reference to a brain drain, the articles centers on the impact of experts and technicians of the industrialized countries in promoting technical progress in the third world and movement of students towards the industrialized world.

In conclusion : the south-north exodus of scientists is not given much attention in the published appraisals. Studies are more inclined to address aspects of technological transfer, the role of experts in these subjects and, basically, the role assumed by the transnational corporations [4].

The specific subject of emigration of scientists within the general context of greater movement, poses some questions we consider relevant to this seminar : How is the accumulation of knowledge operating in reality ? Is there a tendency to an even greater accumulation of knowledge in the industrialized countries ? Can it be considered that in this aspect there is, or will be, a process of " relocating investments " tending to maintain highly qualified resources in their places of origin, but working for the major centers ? What could this relocation of investment mean for the scientific development of the Southern cone ?.

Answers to these questions are complex for different reasons. First, a dominant characteristic today is uncertainty regarding the future of economic development in the Southern countries. Secondly, more research is needed on these subjects to pinpoint the problems.

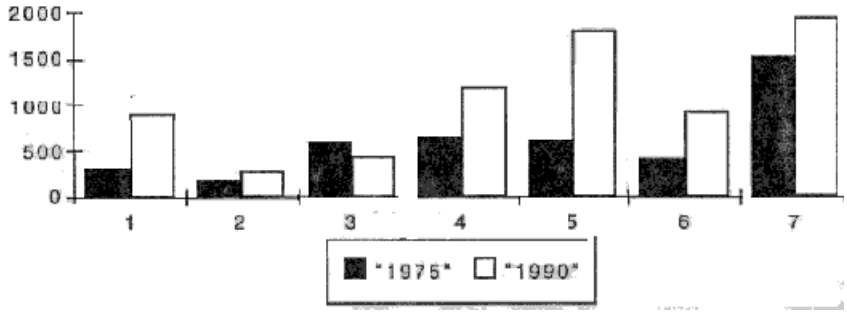
The demand for scientists and more generally for professionals and technicians, reveals one of the central aspects of the matter we are discussing, and the need to see how the concentration of knowledge would take place within this diversified geographic investment framework and the new international division of labor.

The industrialized countries, competing for progress in academic and research fields, face difficult problems : an aging population results in a reduced number of young people reaching the age of higher education. Additionally, there is the tendency, apparently generalized, of a reduction in the vocation for scientific disciplines, including engineering (Massicotte, Guy 1991). In Moving Beyond Myths, a paper summarizing the results of the study made by the Mathematical Science Committee of the United States, by the year 2,000 there will be a severe reduction in the offer of mathematicians for scientific work and university teaching. Incentives for women, ethnic minorities and immigration is proposed as an option to fill this void. In some industrialized countries, immigration would appear as an answer to the insufficient offer estimated for coming decades.

A report by R. Appleyard, prepared for the International Migrations Organization, claims that, at least in coming years, " countries traditionally receiving immigrants shall continue seeking a growing number of highly qualified and professional immigrants. European countries have also indicated that future demand shall basically address this type of immigrant and any programs in this sense shall give priority to this category " (Appleyard, 1991, p. 68).

The brain drain, in its traditional sense, not only continues to exist but is one of the major problems in the development of national and regional opportunities for scientists. At least with regard to the United States, emigration from Latin American countries has continued to grow according to census data for 1970, 1980, and 1990. Regarding the emigration of scientists, and professionals and technicians in general, a previous paper (Pellegrino, 1993) showed a growth of professionals and technicians in the census of 70 and 80. We lack census data for 1990. Nevertheless, in chart 1 we have tried to summarize census data for persons born in some South American countries and having bachelor and post-graduate degrees. These figures show that in some cases the number of South Americans holding post-graduate degrees and living in the United States is significant as compared to their countries of origin.

Data of admissions, that is visas granted by the United States Immigration and Naturalization Service, show that between 1975-90, the categories of engineers and similar, mathematicians and computer experts, and teachers (including University professors) showed a significant increase as compared to other categories (graph 1).



Graph 1. Professionals and technicians admitted to the United States per profession. Years 1975-1990

1. Engineers, architects and similar
2. Mathematics, computer experts
3. Physicians, dental surgeons, veterinarians
4. Paramedics and nurses
5. Professors and teachers (including University teachers)
6. Attorneys, social scientists, Priests and similar
7. Other technicians

Source : USA Immigration and Naturalization Service

Regarding the mobility of qualifications, a glance at United States data shows that this type of exchange is basically with Europe, indicating that " brain exchange " mainly involves industrialized countries. Admission categories, including temporary workers (those will special skills and merit, industrial training, company transfers and exchange visitors) show that Europeans account for about 50 % of the visas granted to this type of migrant ; the percentage for Latin Americans is far less and bears little relation to emigration tendencies towards the United States (Pellegrino 1993).

Progressive integration of researchers to " global science " could mean that a successful career depends on meeting the objectives of the major centers of knowledge centers. Success in research is marked by appraisal mechanisms performed in the major centers ; access to publication of papers in international journals, subjects presented in international congresses, cooperative projects with leading research centers.

Here we enter the complex subject of the " relevancy " of research and the role of scientific communities in national development processes. Nothing is further from my intent than to defend the scientific communities in ivory towers, nor giving priority to excessively autonomous projects ; this is a very sensitive and complex subject and we wish to avoid any nationalist visions of scientific progress. But, in the international context, it is worth discussing the internal brain drain. Fortunately, modern communications make it possible to engage in international activities without having to emigrate or transfer. How can this scientific " toll " be avoided, or at least see that its aims do not dominate research subjects ?

In an earlier work, we stressed the need to create programs to stem the exodus of scientists, trying to reassociate them with local communities and regain mobility aimed at growth of national critical masses. This is essential to avoid the restrictions imposed by " confinement " and those of local academic communities. Nevertheless, there is uncertainty regarding the growing concentration of knowledge and advanced technology in the major centers, on the possibility that these strategies can really be integrated to projects benefitting local development.

There are many weaknesses : it is difficult to convince policy-makers that scientific and technological research is a key element in reducing the gap with industrialized countries and, only within a framework of local policies directed at solid scientific ambits, will it be possible to direct work in a way that harmonizes quality and relevance.

Scientific cooperation programs increasingly encourage exchange ; this is clearly advantageous and allows researchers to extend their scope. Nevertheless, if this activity lacks a significant local counterpart, there is a risk that researchers will direct their careers in a direction that is not in keeping with local priorities. This is the case of social science, local studies have little general interest but significant national relevance.

The Uruguayan Case

While emigration abroad has antecedents in the country, the phenomenon appeared in the 60s, accentuating in the 70s with the economic crisis and political events, culminating in the military dictatorship. Being a small country in demographic terms, the impact of emigration was important ; estimating a negative net balance of 310,000 people between 1963-85 or 12 % of the average population for said period. Net emigration rates reached a top in 1972-76 proof of the relation between emigration and political crisis and arrival of the military dictatorship.

Uruguay is a case of exodus from a country with low population growth, and movements originating exclusively in urban areas. If Uruguayan emigration is historically toward countries of the region and mainly Argentina, during this period there were also flows to the United States, Canada, Australia, Europe and other Latin American countries, such as Venezuela.

Masses emigrations during this period had an educational profile slightly above that of the native population. Nevertheless, in the case of the United States, Canada and Venezuela we note a significant tendency to better educated emigrants (Pellegrino 1989).

The emigration during these decades created an emigration culture in the country, and the image, particularly with young people, that prosperity lay outside the country. The Youth Survey in 1989-90 revealed that a quarter of young people hoped to live abroad for at least some time. Furthermore, it was the better educated youths who were more interested in emigrating (Pellegrino, A. Lujan C. 1994).

Towards 1980, census data indicated that around 9 % of all Uruguayan professionals and technicians were living in the United States and another eleven Latin American countries (Pellegrino 1993). This estimate excludes those living in Australia and Europe. There is no accurate assessment of scientists currently living abroad. The Uruguayan network of nationals living abroad operated as a data system and link between ex-patriates, there is a stock of 350-400 people in different situations : those residing abroad permanently, those engaged in post-graduate studies etc. Chart 2 classifies data on Uruguayans currently covered by the network. It is clear that this type of information, the collection method and different ways in which participants submit information, mean it cannot be used to reach statistical conclusions.

A recent study made by CONICYT of Uruguay (Barbato, C. et al.) shows the country has 800 full-time researchers. Therefore, the number of skilled emigrants would appear to be significant, as is the number of Uruguayans involved in post-graduate studies (USA census).

The return to democracy brought initiatives to recuperate this scattering of scientists. First, the National Repatriation Commission was set up with the support of IMO and helped bring back people of all types, particularly scientists and professionals in the academic fields. With the creation of the CSIC (Sectorial Commission on Scientific Research) in 1990, the University of the Republic set up specific programs to reverse the brain drain : The Scientist Contracting Program, giving priority to Uruguayans wishing to return, and the Return Program directed at economic support for those returning (particularly students who left for post-graduate studies) and aimed a facilitating their reinsertion in the university community.

The most innovative effort to stimulate science was the Basic Science Development Program (PEDECIBA) in 1986; this was promoted by the academic community (within the country and abroad) and was supported by PNUD and the Uruguayan government. Another paper at this meeting will refer specifically to this subject, and for this reason we will not deal with it any further here.

At the end of 1990, the Science and Social Science faculties were created. Previously, these subjects had no academic space for development. This meant an increase in the number of researchers in a specific area, and more students choosing these disciplines. Within the CSIC framework, a set of programs was introduced to improve and stimulate academic performance.

Basic Sciences were stimulated via a series of programs. In addition to PEDECIBA, the loan made to CONICYT by the Interamerican Development Bank for science and technology (US$ 36 million over five years) was used to build the Science Faculty, laboratory equipment, and to finance a package of scientific and technological research projects, and production associated programs.

One of the explicit aims of these programs was to retain and recuperate scientists who had emigrated and to provide attractive conditions so that post-graduate students abroad would return.

From the point-of-view of reverting the brain drain, the period following the return to democracy, implied a coordinated effort to reconstruct the scientific community in the country. The best organized nucleus was AFUDEST, composed by a group of academics living in France. An attempt to extend this program to other areas has not been so successful. Currently projects are under way to prepare an audit of Latin American scientists in different parts of the industrialized world in order to encourage them to return.

The Uruguayan case is well-suited to activities aimed at uniting the " internal and external " academic communities for the purpose of increasing the country's scientific capital. A country with a small population, this limits the opportunity to create the critical mass produced by diversity and necessary for today's scientific world. Creating more opportunities via regional integration and merging local and emigrated talent may be a good option.

Scientific development in Uruguay has been marked by the existence of a consolidated community, even if this has been achieved with some difficulty. In our case, it can be said that this is the result of the scientists themselves because there has never been a clearly-defined state policy on scientific and technological development; proof of this is that global investment in research and development continues to be very low [5].

Last year, the government gave priority to reforming basic, secondary and technical education. The aim was to create equality, and to modernize and recuperate a system which at the end of the last century boasted full literacy and the greatest expansion in the continent. Nevertheless, quality has declined sharply in the last twenty years. This policy has come with freezing the budget for higher education and, thus, scientific research (the State university employs 80 % of the researchers in the country). Salaries for university researchers are about one fifth of those in the industrialized countries and what is even worse, for at least the last ten years they are about one third of the average in the region (the comparison is particularly disadvantageous compared to Brazil). There is no mechanism comparable to a national researchers system, which is an academic and economic incentive [6].

There has been important scientific progress in Uruguay but it is a case where the scientific community has created its own momentum, without a strong conviction on the part of the politicians and society in general with respect to its usefulness. Expectations regarding projects generated in recent years may lead to frustration if they are not consolidated, and this may in turn produce a new exodus of scientists and researchers. The effort to send students abroad for PhD courses may mean they don't come back. In our case, recuperation of the scientific base living outside the country and their possibilities within the academic world are incentives, but the counterpart of a national effort to consolidate the critical local masses, continues to be a basic factor in preventing further exodus, both internal and external.

Table 1. USA census data on South Americans per educational level
(age over 18 and born outside the USA)

	Total	**Nat.**	**Not Nat.**
Bachelor degree	70 458	26 546	43 912
Master's degree	24 218	10 125	14 093
Profess. school degree	18 455	7 396	11 059
Doctorate degree	6 347	2 632	3 715
Total	119 478	46 699	72 779

Chart 1. USA census data on South Americans showing educational level, per country of birth
(over 18, chosen countries)

	Uruguayan				Argentine				Chile			
	Nat.	Non. Nat.	Total	%	Nat.	Non. Nat.	Total	%	Nat.	Non. Nat.	Total	%
Bachelors Deg.	519	648	1 167	48.7	4 015	4 575	8 590	46.3	1 733	3 461	5 194	52.6
Master's Deg.	254	276	530	22.2	2 033	2 695	4 728	25.5	987	1 490	2 477	25.1
Prof. School Deg.	160	362	522	21.8	1 842	1 529	3 371	18.1	573	862	1 435	14.5
Doctorate degree	81	95	176	7.3	970	909	1 879	10.1	307	459	766	7.8
Total	1 014	1 381	2 395	100	8 860	9 708	18 568	100	3 600	6 272	9 872	100
	Colombian				Peruvian				Venezuela			
	Nat.	Non. Nat.	Total	%	Nat.	Non. Nat.	Total	%	Nat.	Non. Nat.	Total	%
Bachelors Deg.	9 158	13 340	2 249	862.7	4 599	8 893	13 492	61.3	1 135	5 047	6 182	63.1
Master's Deg.	2 853	3 413	6 266	17.5	1 575	2 494	4 069	18.5.	404	1 978	2 382	24
Prof. School Deg.	2 211	3 491	5 702	15.9	1 131	2 486	3 617	16.4	134	598	732	7.5
Doctorate degree	489	885	1 374	3.8	268	565	833	3.78	147	360	507	5.2
Total	14 711	21 129	35 840	100	7 573	14 438	22 011	100	1 820	7 983	9 803	100

Source: Based on USA Census 1990.

Chart 2. Members of the Uruguayan Networks (Uruguay discussion) broken down by sex,
area of knowledge, type of activity and geographical location

Sex		
Men	281	79.6 %
Women	79	19.8 %
No information	2	0.6 %
Total	353	100 %
Areas		
Agriculture	24	6.8 %
Basic	78	22.1 %
Social & Human	56	15.9 %
Technological	115	32.6 %
Health	16	4.5 %
Arts	4	1.1 %
Others	6	1.7 %
Not relevant	5	1.4 %
No inf.	49	13.9 %
Total	353	100 %
Type of activity		
Undergraduates	44	12.5 %
MA or PhD	110	31.2 %
Researcher/teacher	104	29.5 %
Others (Int. organisms/companies)	60	17.0 %
No inf.	35	9.9 %
Total	353	100 %
Place of Residence		
South America	25	7.1 %
Mexico & Central America	9	2.5 %
USA & Canada	199	56.4 %
Europe	79	22.4 %
Asia (Israel)	30	8.5 %
Australia	8	2.3 %
No inf.	3	0.8 %
Total	353	100 %

Source: Network data (December 1995).

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[1] Examples : In the POPLINE bibliographic base developed by John Hopkins University, only 252 of the 6771 records on international migration for 1975-95 refer to intellectual exodus. In the DOCPAL analysis compiling data for Latin America, only 20 of the 1400 records for 1972-92 refer to international migration of talent. The cumulative index of the International Migration Review (1954-89) has only 4 headings specifically dealing with " brain drain " and 6 with " professionals ".

[2] Refer D'Oliveira e Sousa 1987 for a summary of these activities.

[3] This list certainly does not include all papers. One of the difficulties faced by Latin American researchers is to communicate among themselves. This is usually done via articles in international publications because national publications rarely circulate in other countries of the region.

[4] An exception is the concern on the new situation in Eastern Block countries and the effect on their scientific communities.

[5] CONICYT commissioned a study with Barbato et al which showed scientific/technological investment to be 0.22 %-0.35 % of the GDP depending on the different expenses assumptions considered.

[6] The latest budget, voted in December 1995, created the National Researchers Fund but without assigning specific funds.

Emigración de científicos : el caso de Uruguay

Adela Pellegrino
Wanda Cabella

La migración calificada en la discusión sobre la migración internacional

Mis lecturas se orientan a la literatura sobre migración internacional, fundamentalmente a revistas especificas o la incluida en la literatura demográfica. No cubren los trabajos sobre la emigración de científicos en la bibliografía sobre sociología de la ciencia o los planteos y debates sobre el rol de la ciencia y la tecnología en el desarrollo.

La migración internacional es obviamente un tema de importancia relevante en el mundo contemporáneo. Sin embargo, la investigación empírica no alcanza el volumen de otros aspectos demográficos y su desarrollo teórico está relativamente rezagado frente a otros tópicos como la reproducción de la población, los efectos del proceso de urbanización o el envejecimiento.

Aún así, en la literatura reciente sobre migración internacional el éxodo de científicos, o más abarcativamente del personal calificado, es significativamente menor que el análisis de los movimientos masivos de población [1]. Aunque en los últimos años se observa un esfuerzo mayor en el análisis de los impactos de la migración internacional sobre los países de origen, indudablemente el volumen mayor de trabajos se refiere a los países de recepción, los impactos sobre el mercado de trabajo y los procesos de inserción de los migrantes de la primera y segunda generación.

En la discusión sobre migración y desarrollo y la relación Sur-Norte, la atención ha sido puesta fundamentalmente en el impacto de las remesas y en el traslado de habilidades, tecnologías y ahorros de los migrantes de retorno. En cambio, la selectividad de la migración y sus efectos sobre los mercados de trabajo de los países de origen, ha ocupado un lugar secundario.

Las aproximaciones teóricas sobre la emigración de científicos de fines de los años 60’y la década de los 70’giraron alrededor de la polémica entre las orientaciones llamadas « internacionalistas » y « nacionalistas », que fueran objeto de debate en la reunión sobre « brain drain » realizada en Lausana en 1967, cuyas ponencias fueron publicadas en el libro de Walter Adams (1968). En estas líneas se publicó un buen número de trabajos, en general estudios de caso llevados a cabo durante los anos siguientes.

El debate sobre el « brain drain » y los planteos de los países no desarrollados tuvieron cierto eco en las negociaciones internacionales. En el seno de distintos organismos de Naciones Unidas y en la Organización Internacional para las Migraciones, « la transferencia inversa de tecnología » fue objeto de conferencias internacionales y de resoluciones orientadas a definir políticas. También se promovieron estudios de caso, por países o por regiones. Particularmente en la UNCTAD, el interés se manifestó en una variedad de acciones orientadas a incluir el tema en el debate Norte-Sur [2]. Un esfuerzo significativo fue el emprendimiento de la UNCTAD para contabilizar del capital humano involucrado en el éxodo intelectual.

En el ámbito latinoamericano, los estudios sobre la emigración de personal calificado tienen antecedentes en muchos países de la región. En la década del 60 y principios del 70 el tema tuvo un auge particular en el medio académico argentino. A los trabajos pioneros de Morris Horowith (1962) y Bernardo Houssay (1966), se agrega una serie de estudios realizados por Enrique Oteiza (1965,1966,1967,1 969,1971) sobre la emigración de profesionales, técnicos y obreros especializados argentinos. A la obra de Oteiza se suman los trabajos Sito y Stuhlman (1968), y de Oszlak y Caputo (1973) sobre la emigración de médicos. En la medida que los países avanzaron en el desarrollo de sus sistemas educativos, el tema de la emigración de recursos calificados alcanzó a otros países : Uruguay (Filgueira, 1976), Chile, Colombia, más recientemente a Venezuela (Pedersen, 1988, Valecillos, 1990, Garbi, 1991) y Brasil (Aleixo, 1974) [3].

Una síntesis de la situación en América Latina fue realizada para la Organización de Estados Americanos por Fernando Chaparro en 1971 y el CELADE ha realizado contribuciones en esta dirección : una investigación realizada en 1982 que analiza la emigración latinoamericana hacia EEUU hasta mediados de 1975 (Torrado, 1982) ; en base a los datos censales, de la ronda del 70 y el 80, reunidos en la base de datos IMILA, se realizaron dos informes sobre la movilidad de profesionales y técnicos (Martínez Pizarro, 1989 y Pellegrino,1993).

En el marco del retorno de la democracia, en Argentina y Uruguay se promovieron estudios sobre las comunidades de emigrantes y exiliados que incluyen informaciones sobre stocks de residentes en el exterior y evaluaciones del volumen de recursos calificados (Lattes-Bertoncello, 1986 y Niedworok-Fortuna, 1989).

El contexto actual

En años recientes, las nuevas formas de hegemonía del libre comercio y de la libre circulación del capital tienen lugar en un escenario que presenta diferencias con respecto a las configuraciones anteriores. La aceleración de los llamados procesos de globalización implica fundamentalmente la internacionalización de la producción, de las finanzas y del comercio, cuyos centros de decisión se desterritorializan, acentuando a la vez la centralidad del poder económico de las corporaciones. En este proceso se desdibuja el estado-nación y pierden peso las fronteras nacionales, al tiempo que se produce una nueva configuración de la división internacional del trabajo. El desarrollo de las comunicaciones y de los transportes ha permitido el « achicamiento » del mundo, así como la internacionalización de los medios de comunicación de masas ha acentuado la hegemonía de los modelos ideológicos y de las pautas de consumo occidentales.

Una mirada a la historia permite afirmar que la movilidad del capital y la distribución espacial de las inversiones han tenido una relación consistente con la movilidad de las poblaciones (Brinley Thomas, 1961 ; Saskia Sassen, 1988). Las etapas de libre comercio y de libre circulación del capital han coincidido con la intensificación de los desplazamientos de población que trascienden las fronteras de los estados nacionales.

En el contexto actual se ha buscado movilizar el capital hacia donde se encuentra la mano de obra barata y abundante, con el objetivo de maximizar las ganancias de las empresas y de evitar los costos sociales que la inmigración implica para los países desarrollados. Están en discusión los posibles efectos de largo plazo : la historia reciente ha demostrado que no es evidente que, en todos los contextos donde el capital ha ido al encuentro de mano de obra abundante y barata, se haya producido una retención importante de trabajadores en sus lugares de origen (Sassen, 1988 Lim Lean Lim,1993). Más discutible aún es que esto haya redundado en procesos de desarrollo nacionales que permitieran la incorporación plena de tecnología y de una diversidad de calificaciones de los trabajadores.

La emigración de científicos es un tema específico dentro de la discusión sobre migración y desarrollo. Varios aspectos, de distinta índole, contribuyen a esta especificidad : el espacio académico y de investigación conforman un complejo de situaciones que contribuye a que estos sectores estén en mayor medida conectados con el mercado internacional. La « desterritorialización » del mundo científico no constituye un fenómeno nuevo ; al contrario, su universalidad es una cualidad intrínseca a su existencia.

La generalización de los sistemas de comunicación por vía informática han hecho que el lugar de residencia pierda progresivamente importancia con respecto a las posibilidades de obtener información de trabajar en vinculación con los grandes centros, de participar en los grandes debates, etc.

El rol de las grandes corporaciones transnacionales tiende a sustituir en gran medida las políticas de migración implementadas por los estados nacionales, pasando a constituirse en elementos decisores de quién migra y hacia dónde se traslada. Las vinculaciones con los emprendimientos científicos de las grandes universidades de los países desarrollados han creado espacios de circulación, tanto de recursos profesionales altamente calificados de la ingeniería, de técnicos, de gerentes así como de científicos vinculados a programas tecnológicos.

En la literatura reciente, el análisis de la migración calificada, y en particular de la altamente calificada, se pone énfasis en la circulación. La expresión « brain drain » tiende a ser progresivamente eliminada y se utilizan otras, como « brain exchange », que ponen el acento en la movilidad que tiene lugar tanto desde como hacia los países desarrollados, así como la que tiene lugar entre los países en desarrollo, enfatizando las posibilidades de intercambio y de transferencias de saberes y habilidades que conlleva esta modalidad.

En la tipología sobre migración internacional presentada por Appleyard, (1991) se incluye la categoría « temporary transient professionals » definida como profesionales o trabajadores calificados que migran de un país a otro, generalmente como empleados de compañias internacionales o de otras empresas, bajo la modalidad de « joint-ventures ».

En el volumen que reúne parte de los trabajos presentados a la conferencia sobre migración organizada por la O.C.D.E. en Roma en 1991, A.M. Findlay analiza la movilidad de los migrantes altamente calificados y propone revisar el concepto de « brain drain » a la luz de las transformaciones de los últimos anos. Admitiendo que el « brain drain » de tipo tradicional se conserva en países que mantienen aún políticas de inmigración selectiva (Estados Unidos, Canadá, Australia y más recientemente Japón), la emergencia de nuevas formas de movilidad y el crecimiento de las transferencias de migrantes altamente calificados tanto hacia los países desarrollados como a los no desarrollados, se ha vuelto un elemento central de la economía global. Según este autor, este fenómeno se debe a dos tipos de razones : la primera se relaciona con el hecho de que la mayoría de los países no desarrollados -en la medida que mantienen la tendencia a la importación de bienes de capital que son diseñados y producidos en los países desarrollados- requerirán la importación de especialistas para la instalación, mantenimiento y servicios de los mismos. En segundo lugar, la economía global está siendo progresivamente dominada por las actividades de las corporaciones transnacionales, para las que las transferencias de trabajadores especializados entre los países son esenciales para que sus operaciones sean eficientes.

Retomando un trabajo anterior, realizado con John Salt (1989), el autor resume evidencias sobre las consecuencias que tiene sobre el desarrollo de los países « la nueva división del trabajo » a escala mundial. Sostiene que existen evidencias de que los intercambios de personal altamente calificado en el marco de la reubicación de las companías multinacionales, redundan en muy limitadas transferencias de tecnologías para los países no desarrollados. En primer lugar, afirma, porque estas corporaciones -aunque esto varía según los países y las compañías- son renuentes a permitir el ascenso a puestos administrativos y técnicos de alto nivel a nacionales de países del Tercer Mundo. El sistema, concluye « milita contra la adquisición de competencias y el entrenamiento gerencial de los empleados nativos en las plantas de los países en desarrollo ».

Sus conclusiones apuntan a señalar que, en el marco de mayores restricciones a la migración internacional, la movilidad de sectores altamente calificados se ha incrementado y que este fenómeno se ha dado en particular debido a las acciones de las compañías transnacionales que han tomado el rol de establecer el control de quién y bajo qué circunstancias emigra.

En el volumen publicado por la Unión Internacional para el Estudio Científico de la Población (1992), un capítulo está dedicado a las transferencias en ciencia y tecnología y los flujos migratorios. Allí se señala la escasa atención que este tema ha tenido en el mundo académico y entre los hacedores de políticas. Aunque hay referencias al éxodo de talentos, el énfasis del artículo está centrado en el impacto de expertos y técnicos de los países desarrollados en promover el desarrollo técnico en los países no desarrollados y en los movimientos de estudiantes hacia los países desarrollados.

En conclusión : el éxodo de científicos desde los países del Sur hacia el Norte es un tema poco tenido en cuenta en las evaluaciones publicadas. Los estudios se orientan en mayor medida a aquellos aspectos relacionados con las transferencias de tecnología, el rol de los « expertos » en estos temas y, fundamentalmente, el papel jugado por las corporaciones transnacionales [4].

El tema concreto de la emigración de científicos en el contexto general de intensificación de la movilidad plantea algunas preguntas que creemos que apuntan al objetivo de este Seminario : ¿Cómo está efectivamente operando la acumulación de conocimiento ? ¿Existe una tendencia a la concentración aún mayor del saber en los países desarrollados ? ¿Se puede considerar que en este aspecto hay, o habrá, también un proceso de « reubicación de las inversiones » tendiente a retener a los recursos altamente calificados en sus lugares de origen, pero trabajando en función de los intereses de los grandes centros ? ¿Qué significado podría tener esta reubicación de inversiones sobre el desarrollo científico de los países del llamado Sur ?

Las respuestas a estas preguntas resultan complejas por diferentes tipos de razones. En primer lugar, porque una característica dominante de estas décadas es la incertidumbre sobre el futuro y más aun sobre las modalidades y las formas que puede adoptar el desarrollo económico en los países del Sur. En segundo lugar, porque es necesario avanzar en la investigación sobre estos temas para lograr ubicar precisamente los problemas.

La demanda de científicos, y más en general de profesionales y técnicos, pone sobre la mesa uno de los aspectos centrales de la discusión que nos ocupa y evidencia la necesidad de discutir las normas que adquirirá la concentración del saber en el marco de esta diversificación geográfica de las inversiones y de la nueva división internacional del trabajo.

Los países industrializados en su competencia por alcanzar el desarrollo de sus espacios académicos y de investigación, se enfrentan a temas de compleja resolución : el envejecimiento de la población tiene como consecuencia una reducción de las cohortes de jóvenes que llegan a la edad de realizar estudios superiores. A ello se agrega un tema que parece generalizarse, que es la reducción de las vocaciones hacia las disciplinas científicas, incluyendo las ingenierías (Massicotte, Guy, 1991). En Moving Beyond Myths, trabajo que resume los resultados del estudio realizado por el Comité de Ciencias matemáticas de los EEUU para el año 2.000, se prevé una severa reducción en la oferta de matemáticos para la actividad científica y de docencia en las universidades. El incentivo a las mujeres, a las minorías étnicas y a la inmigración es sugerido como alternativa para llenar este espacio. La inmigración parece continuar siendo, al menos en algunos países desarrollados, una forma de atender una demanda que las proyecciones estiman que seguirá siendo insuficientemente satisfecha en las próximas décadas.

Un informe de R. Appleyard, realizado para la Organización Internacional de las Migraciones (O.I.M.), sostiene que, al menos en los próximos años, « Los países tradicionalmente receptores de inmigración continuarán buscando un número creciente de migrantes altamente calificados y profesionales. Los países europeos también han señalado que la demanda futura será fundamentalmente en tales tipos de migrantes y que los programas de inmigración, allí donde han sido articulados, acordarán prioridad a este tipo de migrantes » (Appleyard, 1991, p. 68).

El brain drain, en su sentido tradicional, no solamente sigue existiendo sino que constituye uno de los problemas centrales a resolver en el marco del desarrollo de los espacios científicos nacionales y regionales. Al menos en lo que refiere a los Estados Unidos, la emigración desde los países latinoamericanos ha continuado creciendo como lo revelan los datos censales de los anos 70, 80 y 90. Con respecto a la emigración de científicos y más en general de profesionales y técnicos, en un trabajo interior (Pellegrino, 1993), se mostraba el crecimiento de profesionales y técnicos para los censos del 70 r del 80. No disponemos de una información comparable en el caso del Censo de 1990. Sin embargo, en el Cuadro 1 hemos resumido la información censal sobre las personas nacidas en algunos países sudamericanos con títulos de grado y de posgrado. Estas cifras develan que, particularmente en algunos casos, el número de sudamericanos con calificaciones universitarias de posgrado presentes en los Estados Unidos representa un porcentaje considerable con respecto a sus países de origen.

Los datos relativos a las admisiones, es decir al otorgamiento de visas de residencia por el Servicio de Inmigración y Naturalización de los Estados Unidos, muestran que entre 1975 y 1990 las categorías de Ingenieros y afines, de Matemáticos y especialistas en computación y de Profesores y Maestros (que incluye a los profesores universitarios) mostraron un crecimiento significativo con respecto a otras categorías (Gráfico 1).

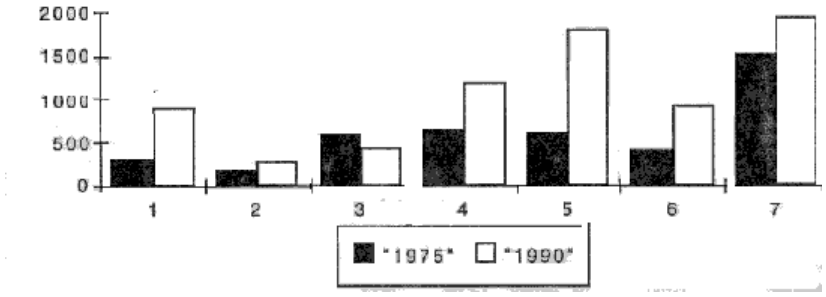


Gráfico 1. Profesionales y tecnicos admitidos en los estados unidos segun profesiones
Años 1975 Y 1990.

1. Ingenieros, arquitectos y afines. 2. Matemáticos, especialistas en computación. 3. Médicos, dentistas, veterinarios. 4. Paramédicos y enfermeros 5. Profesores y maestros (incluye docentes universitarios) 6. Abogados, científicos sociales, religiosos y afines. 7. Otros técnicos.
Fuente : Immigration and Naturalization Service, EEUU.

Con respecto a la movilidad de competencias, una mirada a los datos de los Estados Unidos, muestran que este tipo de intercambios tienen lugar fundamentalmente con Europa, lo que evidencia que la modalidad « brain exchange » involucra prioritariamente países desarrollados. Las categorías de admisión que incluyen a los trabajadores temporarios (trabajadores con habilidades y méritos especiales, entrenamientos industriales, transferencias de compañías y visitantes de intercambios), muestran que los europeos ocupan alrededor del 50 % de las visas otorgadas a este tipo de migrantes ; el lugar ocupado en ellas por nativos de países latinoamericanos es notoriamente inferior y no guarda relación con las tendencias de la emigración hacia los EEUU (Pellegrino, 1993).

La integración progresiva de los investigadores a la « ciencia global », puede llevar a que el ingreso y el desarrollo de una carrera exitosa estén determinados por objetivos que responden

Cuadro 1a. Sudamericanos censados en EEUU por nivel de formación alcanzado
(Mayores de 18 años y nacidos fuera de EEUU)

	Total	**Nat.**	**Non nat**.
Bachelor Degree	70 458	26 546	43 912
Master's Degree	24 218	10 125	14 093
Profess. School degree	18 455	7 396	11 059
Doctorate degree	6 347	2 632	3 715
Total	119 478	46 699	72 779

Cuadro 1b. Sudamericanos censados en EEUU por nivel de formación alcanzado según país de nacimiento (mayores de 18 años, países seleccionados)

	Uruguayos				Argentinos				Chilenos			
	Nat.	Non nat.	Total	%	Nat.	Non nat..	Total	%	Nat.	Non nat.	Total	%
Bachelors Deg.	519	648	1 167	48.7	4 015	4 575	8 590	46.3	1 733	3 461	5 194	52.6
Master's Deg.	254	276	530	22.2	2 033	2 695	4 728	25.5	987	1 490	2 477	25.1
Prof. School Deg.	160	362	522	21.8	1 842	1 529	3 371	18.1	573	862	1 435	14.5
Doctorate degree	81	95	176	7.3	970	909	1 879	10.1	307	459	766	7.8
Total	1 014	1 381	2 395	100	8 860	9 708	18 568	100	3 600	6 272	9 872	100
	Colombianos				Peruanos				Venezolanos			
	Nat.	Non nat.	Total	%	Nat.	Non nat..	Total	%	Nat.	Non nat.	Total	%
Bachelors Deg.	9 158	13 340	2 249	862.7	4 599	8 893	13 492	61.3	1 135	5 047	6 182	63.1
Master's Deg.	2 853	3 413	6 266	17.5	1 575	2 494	4 069	18.5.	404	1 978	2 382	24
Prof. School Deg.	2 211	3 491	5 702	15.9	1 131	2 486	3 617	16.4	134	598	732	7.5
Doctorate degree	489	885	1 374	3.8	268	565	833	3.78	147	360	507	5.2
Total	14 711	21 129	35 840	100	7 573	14 438	22 011	100	1 820	7 983	9 803	100

a los objetivos de los grandes centros del saber. El éxito en las trayectorias de investigación está pautado por mecanismos de evaluación que tienen lugar en los grandes centros : acceso a la publicación de trabajos en las revistas internacionales, temas plateados en los congresos internacionales, proyectos en cooperación con los grandes centros de investigación.

Aquí entramos en el complejo tema de la « pertinencia » de la investigación y del rol de las comunidades científicas en los procesos de desarrollo nacionales. Nada más lejos de mi intención que defender la existencia de comunidades científicas encerradas sobre si mismas, ni la prioridad a los proyectos excesivamente autónomos. Este tema es sumamente delicado y complejo y quisiéramos evitar todo tipo de visiones nacionalistas del desarrollo de la ciencia. Pero en este contexto internacional, ¿no será útil discutir también el « brain drain » interno ? Los medios de comunicación permiten hoy en día, por suerte, la realización de actividades internacionales sin tener la necesidad no ya de emigrar sino también de trasladarse. ¿Cómo evitar la « maquila » científica o, al menos, lograr que sus objetivos no dominen totalmente los temas de investigación ?

En un trabajo anterior, afirmábamos la necesidad de crear programas que permitieran recuperar el caudal del éxodo científico, buscando revincularlo a las comunidades locales asi como recuperar la movilidad en aras del crecimiento de las masas críticas nacionales. Esta es una medida imprescindible para evitar las limitaciones que impone el « encerramiento » y las limitaciones de los medios académicos locales. Sin embargo, se plantea la duda, frente a la creciente concentración del saber y de la alta tecnología en los grandes centros, sobre las posibilidades de que estas estrategias puedan realmente integrarse a proyectos que redunden en beneficios para el desarrollo local.

Las debilidades son muchas : existen muchas dificultades para convencer a los « hacedores de políticas » que el desarrollo de la investigación científica y tecnológica es un elemento clave para reducir la brecha con los países desarrollados y que solamente en el marco de políticas locales que permitan la generación de ámbitos científicos sólidos se podrá orientar el trabajo de manera que la calidad se compatibilice con la « pertinencia ».

Los programas de cooperación científica tienden progresivamente a estimular los intercambios. Es evidente su utilidad y la posibilidad que generan de « ampliar el mundo » de los investigadores. Sin embargo si esta actividad no tiene una contrapartida local de importancia, corre el riesgo real de dividir las carreras de investigadores en función a las orientaciones no elegidas o no acordes con prioridades de investigación en los ámbitos nacionales. La ciencia es universal pero los niveles de universalidad varían mucho con las disciplinas. En el caso de las ciencias sociales, los estudios locales tienen poco interés de tipo general y mucha pertinencia nacional.

El caso de Uruguay

Aunque el tema de la emigración fuera de fronteras tiene antecedentes históricos en el país, el fenómeno de la emigración de uruguayos comienza a perfilarse en los años 60, toma un ritmo muy importante en los anos 70, en el marco de la instalación de la crisis del modelo económico y de la conflictividad política que culmina con la dictadura militar. País pequeño desde el punto de vista demográfico, el impacto de la emigración sobre la población fue muy importante : se ha estimado un saldo neto negativo de 310.000 personas entre 1963 y 1985 equivalente al 12 % de la población media del período. Las tasas netas de emigración alcanzaron sus niveles máximos entre los años 1972 y 1976 evidenciando la incidencia en el fenómeno emigratorio del agravamiento de la crisis política y del advenimiento de la dictadura militar.

Uruguay constituye un ejemplo de país expulsor de población en un contexto de bajo crecimiento demográfico y de movimientos originados exclusivamente desde el área urbana. Si históricamente la emigración de uruguayos se dirigía hacia los países de la región y fundamentalmente hacia Argentina, en este período se observan flujos hacia Estados Unidos, Canadá, Australia, los países europeos así como hacia otros países latinoamericanos, como es el caso de Venezuela.

El perfil educativo general de la emigración, en esta etapa de emigración masiva es levemente superior al de la población nativa. Sin embargo, si se tienen en cuenta los destinos migratorios la emigración hacia algunos países de la región como es el caso de Venezuela y la que se dirigió a Estados Unidos y Canadá, la selectividad hacia grupos promedialmente más educados es notoria (Pellegrino, 1989).

La emigración de estas décadas dejó como secuela la instalación de una cultura emigratoria en el país y la imagen interiorizada en la población, y particularmente entre los jóvenes, de que las posibilidades de prosperar están fuera de las fronteras. La Encuesta de juventud realizada en 1989-1990 permitió observar que un cuarto de los jóvenes declaraban que aspiraban a vivir, al menos transitoriamente, fuera del país. Por otra parte eran los jóvenes con un promedio educativo mayor los que evidenciaban una propensión emigratoria más alta. (Pellegrino, A., Luján, C.,1994).

Hacia 1980 los datos censales permitieron estimar que alrededor del 9 % del total de profesionales y técnicos del país se encontraba en los Estados Unidos u otros 11 países latinoamericanos. (Pellegrino 1993). Esta estimación no tiene en cuenta a los residentes en países europeos o en Australia. No existen evaluaciones precisas sobre el volumen de científicos actualmente residentes en el exterior. En la red de uruguayos residentes en otros países que funciona como un vehículo de información y vínculo entre uruguayos expatriados, se mantiene un stock de entre 350 y 400 personas en diferentes situaciones : residentes definitivos fuera, estudiantes que se encuentran realizando estudios de posgrado, etc. En el Cuadro No.2 se presenta un ordenamiento de los datos disponibles sobre los uruguayos que participan en la red. Resulta evidente que por el tipo de información de que se trata, por la peculiaridad del sistema de reclutamiento y por la heterogeneidad con que los participantes presentan la información sobre sus actividades, profesión, etc., no se debe extraer de estos datos ninguna clase de conclusión estadística.

Según un estudio realizado recientemente para el CONICYT de Uruguay (Barbato, C. et al.), el número de investigadores a tiempo completo en el país es de 800 personas. Por lo tanto, el número de emigrados calificados parece por demás significativo, como lo es también el número de uruguayos censados, con títulos de posgrado en el Censo de los Estados Unidos que presentamos en el Cuadro 1b.

La reintegración del país al sistema democrático fue acompañada de varias iniciativas tendientes a recuperar la diáspora científica. En primer lugar, se creó la Comisión Nacional de Repatriación que, con el apoyo de la OIM, contribuyó a la reintegración al país de todo tipo de

Cuadro 2. Integrantes de la red de Uruguayos (Uruguay-discusión) según sexo, área de conocimiento, tipo de actividad y región geográfica de residencia

Por sexo		
Hombres	281	79.6 %
Mujeres	79	19.8 %
S/información	2	0.6 %
Total	353	100 %
Por áreas del conocimiento		
Agricultura	24	6.8 %
Básicas	78	22.1 %
Sociales y Humanas	56	15.9 %
Tecnológicas	115	32.6 %
Salud	16	4.5 %
Artes	4	1.1 %
Otras	6	1.7 %
No corresponde	5	1.4 %
S/información	49	13.9 %
Total	353	100 %
Por tipo de actividad		
Estudiantes de grado	44	12.5 %
Estudiantes de master o doctorado	110	31.2 %
Investigador/docente	104	29.5 %
Otras ocupaciones	60	17.0 %
S/información	35	9.9 %
Total	353	100 %
Por lugar de residencia		
Sur América	25	7.1 %
México y América Central	9	2.5 %
USA y Canada	199	56.4 %
Europa	79	22.4 %
Asia (Israel)	30	8.5 %
Australia	8	2.3 %
S/información	3	0.8 %
Total	353	100 %

Fuente : Información procesada basándose en la lista de integrantes en la red (diciembre de 1995).

retornantes, aunque jugó un papel importante en la reintegración de científicos y profesionales vinculados al medio académico. Con la creación de la CSIC (Comisión Sectorial de Investigación Científica), en 1990, en la Universidad de la República, se crearon programas específicos orientados a revertir la fuga de cerebros : el Programa de contratación de científicos, donde la prioridad se otorga a los uruguayos que quieran retornar y el programa de retorno orientado a apoyar económicamente a los retornantes (en particular estudiantes que salieron a realizar estudios de posgrado) a los efectos de facilitar su reinserción en el medio universitario.

Desde el punto de vista de las iniciativas para estimular el desarrollo del ámbito científico, el emprendimiento más innovador fue la creación del Programa de Desarrollo de las Ciencias Básicas (PEDECIBA) en 1986. Esta iniciativa surge por impulso de la comunidad académica (dentro y fuera del país) y logra consolidarse con el apoyo del P.N.U.D y del gobierno uruguayo. Otra ponencia en esta reunión se referirá concretamente a este tema, por lo que no nos extenderemos sobre su impacto en la retención y recuperación de científicos.

En el medio universitario, a fines de 1990 se formalizó la creación de la Facultad de Ciencias y de la Facultad de Ciencias Sociales, que hasta entonces no contaban con un espacio propio de desarrollo académico. La creación de ambas Facultades significó una expansión del número de investigadores en un espacio específico, así como del número de alumnos que optan por este tipo de disciplinas. En el marco de la CSIC se implementan un conjunto de programas orientados a mejorar y estimular la actividad académica.

Las Ciencias Básicas contaron con un volumen de programas nuevos destinados a su estímulo. Además del PEDECIBA, el préstamo realizado al CONICYT por el Banco Interamericano de Desarrollo para el desarrollo de la ciencia y la tecnología (de 36 millones de dólares, sobre 5 años) sirvió para la construcción de un edificio para la Facultad de Ciencias, para el equipa-

miento de sus laboratorios, así como para el financiamiento de un paquete de proyectos de investigación científica y tecnológica y de programas de vinculación con la productiva.

Uno de los objetivos explícitos de estos programas, fue la creación de espacios de estímulo para a retención y recuperación de científicos emigrados y permitir un mejoramiento de las condiciones de trabajo para estimular el retorno de los estudiantes que realizan sus posgrados en el exterior.

Desde el punto de vista de la revinculación con la comunidad científica emigrada, el período posterior al retorno de la democracia, implicó una unificación de esfuerzos en aras de la reconstrucción científica del país. El núcleo más organizado lo constituyó la AFUDEST, formada por un conjunto de académicos radicados en Francia. El esfuerzo de ampliar esta iniciativa a otros espacios no ha dado frutos de similar continuidad. Existen actualmente proyectos en curso para elaborar un inventario de científicos latinoamericanos radicados en el mundo desarrollado a los efectos de promover su vinculación y el retorno.

El caso de Uruguay resulta particularmente propicio para este tipo de actividades que tiendan a unificar las comunidades académicas de « adentro y de afuera » para incrementar el capital científico del país. País pequeño en el plano demográfico, el espacio nacional es limitado para constituir la masa crítica propia en la diversidad que requiere el mundo científico de hoy en día. La creación de espacios ampliados, en el marco de la integración regional y de la unificación de las comunidades académicas migradas con las nacionales, parece ser una alternativa promisoria.

La existencia de una comunidad que, aunque con dificultades, se ha consolidado, ha marcado los ritmos del desarrollo científico uruguayo. En nuestro caso, se puede decir que fueron las presiones de los propios científicos los que han determinado el crecimiento, ya que no ha existido una política clara y definida desde el poder estatal con respecto al desarrollo científico y tecnológico : por ejemplo, la inversión global en investigación y desarrollo sigue siendo muy baja [5].

En el último año, los objetivos prioritarios del gobierno se han orientado hacia la reforma de la educación básica, media y técnica. Desarrollado con el propósito de generar situaciones de equidad indiscutibles, este programa está destinado a modernizar y recuperar un sistema que conoció como reforma escolar importante en el último cuarto de siglo pasado, la alfabetización plena y la expansión mayor en el continente. Sin embargo, declinó fuertemente en su calidad en los últimos 20 años. Esta política ha sido acompañada por el congelamiento del presupuesto en educación superior y, por lo tanto, en investigación científica (ya que la Universidad estatal ocupa al 80 % de los investigadores del país). Los salarios de los investigadores universitarios son aproximadamente un quinto de los del mundo desarrollado ; lo más grave es que son, -y han sido desde hace por lo menos una década- un tercio de los de la región (la comparación es desventajosa particularmente con respecto a Brasil). No existe ningún mecanismo comparable al de un sistema nacional de investigadores [6], que constituya un estímulo académico y económico para los mismos.

En Uruguay se han realizado avances importantes en el desarrollo científico, pero se trata de un caso típico donde la comunidad científica ha adquirido una dinámica propia sin un convencimiento fuerte de parte del poder político de su utilidad, y de parte de la sociedad en su conjunto. Las expectativas generadas en torno a los proyectos iniciados en los últimos años pueden culminar en frustraciones si no se las consolida y esto puede llevarnos a una nueva fase de emigración de científicos e investigadores. El esfuerzo de enviar estudiantes a realizar doctorados en el exterior puede culminar en no retornos, perdiendo parte de los esfuerzos acumulados en los últimas anos. En nuestro caso, la recuperación del caudal científico radicado fuera del país y las modalidades de movilidad a que tiene acceso el mundo académico, resultan factores estimulantes, pero la contrapartida de esfuerzo nacional en materia de consolidación de las masas críticas locales, sigue siendo un factor fundamental para evitar un nuevo éxodo, tanto externo como interno.

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[1] Para mencionar ejemplos : en la base bibliográfica POPLINE desarrollada por la Universidad John Hopkins, de 6771 registros sobre migración internacional, correspondientes al período 1975-1995, solamente 252 se refieren al éxodo intelectual. En otra base, que recoge la información sobre América Latina que se lleva a cabo en el DOC-PAL, para el período 1972-1992 de 1400 registros sobre migración internacional solamente 20 refieren a la migración internacional de talentos. El índice acumulativo de la Revista International Migration Review (1964-1989) contiene solamente 4 titulos dedicados especificamente al tema del « brain drain » y 6 a « professionals ».

[2] Una síntesis de estas actividades se encuentran en D'Oliveira e Sousa, 1987. Una síntesis de estas actividades se encuentran en D'Oliveira e Sousa, 1987.

[3] Seguramente esta lista no incluye la totalidad de los trabajos. Una de las dificultades para los investigadores latinoamericanos es la dificultad de leerse los unos a los otros. Salvo los artículos publicados en Revistas Internacionales, las publicaciones nacionales de cada país tienen poca circulación fuera de fronteras.

[4] Una excepción a esto refiere a la preocupación surgida a propósito de la nueva situación de los países del Este y sus efectos sobre sus cominidades científicas.

[5] Según el estudio realizado a pedido del CONICYT por Bartbato et al, la inversión en ciencia y tecnología se ubicaba entre el 0.22 % y el 0.35 % del P.B.I., según las diferentes hipótesis de gasto tenidas en cuenta

[6] En el último Presupuasto nacional, votado en diciembre de 1995, se creó un Fondo Nacional de Investigadores, aún sin asignación de recursos económicos específicos.

Scientific Migrations, Cooperation and Development Networks in Latin America and the Caribbean

Guillermo Cardoza
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Crisis, Migrations and Economic Restructuration

The recent economic crisis of Latin America, the most serious and extended of the history of the region, characterized by the decline of productivity and a higher vulnerability towards external disturbances, made evident the extinguishment of the industrialization mode of imports substitution, the weak international insertion of the countries of the region and the inability by the States to face the crisis efficiently. In addition, the rapid progress of the production technologies and the new conditions of competence prevailing in international trade had led to a fast erosion of the comparative advantages presented by the countries of Latin America because of natural resources abundance and of low cost of labor (Cardoza and Villegas, 1996).

In accordance with data from the Inter American Development Bank (IDB, 1993), the countries of Latin America showed decreases in the average annual grow rate of the gross domestic product (GDP) per inhabitant (from 3.3 % to -1.1 %) and in the average annual growth rate of gross internal investment (from 7.2 % to -3.0 %) of the decade of the ‘70s to the ‘80s. Simultaneously, during the decade of the ‘80s some countries reached average annual inflation rates of three digits.

As an answer to improve their insertion in the world economy and re-take the road of economic and social growth, the Latin American countries are carrying out structural reforms, enphasizing productive restructuration and internationalization of their economies, which will allow them to reach macroeconomic stabilization, increase their and revert the weight of the legacy from the former development model.

However, as we have already indicated, the success of these reforms may be endangered since the perverse effects of the transfer of financial resources corresponding to the foreign debt is added now to the migration of scientists and professionals to industrialized countries. Certainly, the overcoming of the structural barriers that maintain the region behind and determine an impoverishing insertion pattern within a highly competitive context requires the adoption of a knowledge intensive economic model that will permit to take advantage of the opportunities offered by globalization. In order to reach this purpose, in addition to considerable investments, it is necessary to guarantee the participation by scientists, engineers and other professionals with high qualifications, an important portion of whom has emigrated to developed countries.

The lack of complete and detailed statistics on the migratory phenomenon makes the analysis and assessment of its impact on the development of Latin American countries difficult. Estimates made by Alvarez (1993) based on the data supplied by the Immigration and

Naturalization Service of the United States of America indicates that in the three decades from 1961 to 1990 approximately 500,000 professionals and highly qualified personnel from the countries of the region emigrated to the United States of America. It is legitimate to think that this tendency may have accentuated with the aggravation of the economic crisis during the '90s since productive investments that generate employment have been reduced and important reductions in the Research and Development (R & D) budgets in some countries of the region have been made. If in addition we take into consideration the shortage of scientists and engineers that has been forecasted in some developed countries and the selective immigration policies implemented in them in order to correct them, it is anticipated that these migratory flows have been intensified and continue increasing in the next few years.

The Excluding Globalization and the Exodus of Talents

The progressive marginalization of Latin American countries in business exchanges at a worldwide level and their loss of importance as receivers of direct foreign investment (DFI) and the flows of technology, define very clearly the contours of the 'excluding globalization'process in course. In 1950 the exports from Latin America represented 12.4 % of the world's total and its imports were 10.1 % while for 1990 these figures fell to 3.6 % and 4.3 % respectively. This situation is even more serious if we consider the progressive deterioration of the terms of tarde for the main primary export goods and that, notwithstanding the increase in manufacturing exports, the exchange structure continues based on the exportation of raw materials and intermediate goods with few transformation.

It can be observed that the participation by Latin America as a receiving region of direct foreign investment (DFI) for developing countries fell 12.3 % for the period 1980-84 and to 5.8 % for 1988-89. It is also observed that Latin America as a region is being gradually dislodged by Asian countries as receiver of DFI intended for developing countries.

Also, regarding the technology flows towards developing countries, it is possible to observe that they are distributed unevenly and that they also tend to be concentrated in recently industrialized Asian countries. As pointed out by the Organization of Economic Cooperation and Development (OECD, 1992) the situation gets even worse by the adoption of intellectual property regimes which restrict the access of developing countries to technologies that they need to increase their competitiveness and to establish the bases of a fair economic and social growth model.

In addition, the crisis imposes severe restrictions to the countries of the region to increase their investments and education and R & D budgets. Several countries (Bolivia, Chile, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Mexico and Venezuela) had an important decrease of the expenses for education, expressed as percentage of the GDP between 1980 and 1990. In addition, it may be observed that for none of the countries the R & D expenses reached 1 % of the GDP and to the contrary, countries such as Guatemala, Ecuador, Mexico and Paraguay had decreases in this indicator during the '80s. In addition, most of the countries suffered important reductions in the per capita income and in the internal gross investment during the same period.

The group of these factors, causing the economic, political and social crisis of the countries of the region, determines also the increasing migration of professionals and highly qualified personnel. The estimated number of professionals and highly qualified personnel emigrated from Latin America to the United States keeps increasing since the '60s.

The Exodus of Talents and the Retention and Return Policies

During the decades of the ‘60s and ‘70s there was an increasing concern for the phenomenon of brain drain, which motivated its inclusion as central subject in the agenda of discussions of different international organizations. The United Nations Institute for Training and Research (UNITAR) published studies on the emigration of highly qualified people from developing countries (Henderson, 1970 ; UNITAR, 1971 ; Glaser, 1978). The United Nations Conference on Trade and Development (UNCTAD, 1974, 1975) in turn, engaged several studies about the ‘reverse transfer of technology’and its economic impact on the developing countries. Also, several studies were carried out at the request of UNESCO on the emigration of scientists and technologists (KcKingth, 1971 ; SPD, 1968). Also in specific fields such as health science, reports were prepared on the migration of professionals (WHO, 1974, 1975, 1976).

These studies on the migration of talents were centered on the identification and analysis of the factors and motivations that determine migrations and on the policies to offset them. In different degrees of detail the studies took into account variables such as the income differences between developed and developing countries and the unbalance between the excess of scientists and skilled professionals and the limited capacity for absorption of the local labour markets (Grubel and Scott, 1977 ; Glaser and Habers, 1978). In the same way, these studies also pointed out that the migratory flows of highly qualified people are determined by the needs for human resources proper of the economic growth cycles of developed countries.

The analysis coincide in indicating as causes for migration of scientists and engineers, among others : the lack of compensation systems that will adequately value the degrees or educational levels and experience of these professionals ; the lack of adequate infrastructures and, the lack of critical masses that will permit to break isolation. To this respect it is noted that the lack of possibilities for updating in the frontier fields and the efficient communication systems generate a progressive isolation by researchers which it is only possible to break, ceteris paribus, emigrating towards developed countries which in addition to good compensations offer labor stability, promotion systems based on productivity and efficiency criteria, and most important, intellectual environments proper and stimulating for a creative work (Villegas and Cardoza, 1993). Referring to the exodus of the scientists Dedijer (1962) pointed out that “ it is only a symptom of relatively illogical conditions for the development of science ”.

On the other hand, policies oriented to offset the exodus of talents that go from the implementation of restrictions on departure based on national laws on the immigration and visas to the imposition of a tax to professionals who emigrate to industrialized countries and the creation of inter-government schemes for compensation to the developing countries for the loss of their qualified human resources (Bhagwati and Partington, 1976 ; Grubel and Scott, 1977).

In addition to the study of the determinant factors of the migratory phenomenon, theoretical models have been proposed for the analysis of economic aspects of international migratory flows of highly qualified personnel and their impact on the well being of the societies of the countries of origin of the emigrated people (Grubel and Scott, 1977). In the quantitative analysis of the migration different approaches have been used, such as : the evaluation of the savings represented for the country that receives the qualified immigrant ; the estimates of the present value of the human capital of migrants based on expected future income ; the costs associated to the loss of well being of the population of origin of the migrants and the losses associated to the reduction in savings and in the collection of taxes due to migrations [1].

The recommendations contributed by these studies in regards to the policies of return and retention of scientists and engineers are still valid for most of the Latin American countries. As indicated by the Intergovernmental Committee for Migrations (ICM, 1985), the programs to encourage the return migration of qualified human resources " should concentrate on well defined objectives, among them the provision of specific vacancies in high level positions, extremely selective hiring criteria and recognition of the need for attractive work conditions, including financial, material and psychosocial assistance ".

In order to guarantee their efficiency, the programs of recovery and retention of qualified human resources must contemplate, in addition, the offer of resources to finance the visits of the researchers to the laboratories of colleagues where they will receive the necessary training for their updating and in many cases, due to the lack of the proper infrastructure, the possibility of carrying out part of their research. Thus, it is recommended that it is necessary to obtain a proper balance between their scientific work and their teaching and management activities in order to guarantee that they can dedicate enough time to consolidate their career in a highly competitive international environment. Pedersen (1988) adds to this respect that the incentives for those who return must include, among others, personal development opportunities, mechanisms to maintain international contacts, offers for home solutions and systems for social recognition and status.

With respect to the retention or settlement of highly qualified human resources, in the evaluation made by COLCIENCIAS of the Program of Return of Professionals of Colombia (Decree 1397 of 1972), Cardona et alii (1980) indicated that " more important than repatriating those who have emigrated, is to retain potential emigrants ". Certainly, in addition to developing an internal labour market for researchers with competitive salaries and an adequate physical infrastructure, it is necessary to advance in the constitution of critical mass of researchers preferentially in fields in which it is possible to make a better use of the factors endowment. In this process, the cooperation of scientists and engineers who reside in Latin America with the researchers of the region who work in the developed countries represents an important element to be considered in the design of scientific, technological and industrial development policies.

From Brain Drain to Brain Gain. The Advantages of Cooperation With Emigrated Scientists and Engineers

Contrary to the emphasis placed on 'brain drain'and 'repatriation of brains'as central elements in the national policies related to the migration of talents, now the adoption of a more pragmatic approach in the concept of 'brain gain' is suggested, which will promote the utilization of the potential of scientific and technical cooperation associated to the hiring of emigrated scientists and engineers.

In principle, the scientists and engineers connected to research centers and public and private companies of industrialized countries may perform an important role in the construction of an endogenous capacity for R & D in their countries of origin through their contribution to the formation of human resources for R & D, facilitating the access to information systems and promoting the performance of joint research projects.

Due to the positions held by a large portion of migrated professionals who work in centers of academic excellence in developed countries, it is also possible to find advisory services for the creation of postgraduate degrees in those areas where the countries of the region may require highly qualified professionals and researchers. In addition, the emigrated colleagues would be

in a position to offer different possibilities for educational and scientific cooperation : education programs at a doctorate or postdoctorate level for students of the region ; short term training on specific subjects and advice on the formulation, assessment and execution of research projects ; trainee periods and sabbatic years to dictate courses ; co-tutorship of graduation works. In general, the relations with emigrated academics may lead to inter-institutional agreements for the formation and training of human resources.

The experience of emigrated scientists, engineers and other professionals in the use of new technologies and their professional relations represent also resources of great value in the process of formulation and assessment of policies for the transmission of know-how and the disclosure of technologies, and in the advisory services provided to institutions and companies in the process of incorporating foreign technologies for the increase of their international competitiveness. In effect, at the level of industrial modernization processes the emigrated professionals may give their cooperation to translate the needs of the users in technological terms. Their advice may be extended from the search and proper selection of the technologies, up to the negotiation or their acquisition and the modalities for transfer. Later on their services are basic to guarantee, together with local personnel, the assimilation, adaptation and eventually the change and creation of new technologies.

On the other hand, emigrated professionals may offer advisory services in engineering and design necessary to support the processes of productive modernization carried out in the region. Their assistance may facilitate both the access and the assimilation of advanced technologies of manufacture and the introduction of the new paradigm of organization of production. Various organizational and management methodologies and techniques (quality circles, total quality, reverse engineering, handling of inventories, just-in-time, etc.) may be more rapidly and efficiently transferred and assimilated with the aid of the professionals of Latin America settled in the developed countries (Cardoza, 1994).

As we may appreciate, the engagement of emigrated scientists, engineers and high quality personnel may represent a fundamental contribution for the creation of the transfer networks and accumulation of knowledge necessary to develop a methodology for learning the technological development in the countries of the region. It is known that these new modalities of scientific and technological cooperation represent a privileged source in the process of ‘learning and innovating’.

However, the optimal use of this source of technical and scientific cooperation represented by the involvement of emigrated personnel, depends precisely on the capacity to create and operate structures that will connect them not only to their colleagues but that will promote the establishment of relations with all the actors involved in the innovation processes at a national and regional levels.

Global Scientific Community of Latin America and the Caribbean. From the Diaspora to the Network of Scientific and Technological Cooperation

The new telecommunication technologies, especially the Communication by Computer, make possible the accelerated transformation of the ‘invisible college’, characterized by the sporadic and information relation of the researchers, into the global electronic college a structure which foundations are the telematic networks which permit the easy flowing and systematic interaction of researchers who work in a same subject or related fields.

As a consequence of the massive use of the new communication technologies, important changes are being observed both in the method of work of researchers and in the modalities of cooperation. The low cost of communications and the high speed of transmission facilitate the easy flowing exchange between colleagues working in common areas and the origination of cooperation networks among researchers.

The emergency of this new global scientific society permits to break with the isolation of researchers in the developing countries, indicted as one of the main causes of the exodus of talents. The possibilities of interaction offered by the electronic networks between the researchers of the countries of the region and their colleagues abroad facilitates the formation of virtual critical masses and the establishment of cooperative research relations which contribute to the settlement of researchers residents in Latin American countries (Cardoza, 1993).

Currently, telematics facilitates the identification process and the start up of programs connecting emigrated professionals to projects relevant for the development of their countries of origin and of the region itself. In this manner, the notion of national scientists and engineers abroad, permits to realize the concept of Global Scientific Community of Latin America, previously proposed (Villegas and Cardoza, 1993 ; Cardoza and Villegas, 1996). In effect, we state that the possibility of developing a far reaching program of international scientific cooperation based on the role to be played by these professionals residing outside the region doaes exist. As of this extended communication, which goes beyond national and regional frontiers, it is possible to design technological and economic development policies based on a cooperation network that will work as an ‘open window’to available technologies and opportunities offered by international markets.

National Innovation Systems (NIS) and Global Cooperation Networks for Innovation

In order to optimize the cooperation activities and to make efficient the processes of broadcast, assimilation and adaptation of technologies, proper and imported, it has been recommended to establish National Innovation Systems (NIS) (Freeman, 1987 ; OCDE, 1992) in which the institutions of the public and private sector related to the innovation process will participate. In these networks should participate the universities and public institutions of Science and Technology (S & T), the R & D laboratories of the industries, the education and training institutions, the engineering and design centers and national institutions responsible for scientific policies and for the coordination with the business sector.

The good performance of the NIS depends on the establishment of S & T policies in agreement with the economic and social policies contemplated by the national development plan. In addition, this plan must indicate as much as possible the contribution that S & T can make to reach the short, medium and long term objectives defined for each one of the large areas of development (agriculture, health, energy, environment, employment, etc.). The establishment of the priorities and the assignment of the resources must be the result of consensual dialogues which consider both the needs and the actual and potential contributions by all actors of the innovation process.

Currently, the NIS must face the challenge posed by the globalization and internationalization of the activities of creation of knowledge and disclosure of technologies. To this respect, the incorporation of scientists and engineers resident outside the region to the NIS permits to ‘extend’these systems and create Global Cooperation Networks for Innovation that will guarantee a wide disclosure of knowledge and a progressive endogenization of the activities of technological, organizational and institutional innovation. As pointed out by Justman and Teubal (1995) these activities are intended to strengthen the process of ‘learning from cooperation’.

The new modalities of cooperation that arise from the various 'connective'actions claim the creation of favorable environments for the full operational development. It is necessary to have a stable institutional framework and highly motivated promotional teams that will have available efficient information systems and strategic units of specialists in charged of the establishment of priorities, the assignment of resources and the evaluation of the activities. In the same manner, the success of these initiatives depends on the capacity by the NIS to transform the personal connections and contacts of the researchers in specialized networks and in inter-institutional cooperation agreements.

At the level of technical-industrial cooperation, it is desireable that the global cooperation networks for innovation give rise to specialized sectorial subnetworks which will permit that potential users groups of a certain technology share the risks and costs associated to its importation and adaptation. These subnetworks can also share infrastructures of information and formation of human resources. In any event, as indicated by Stewart (1995), the capacity of a single country to apply the S & T developed in other countries depends on the maintenance of a certain level of investigative experience. In fact, at an industrial level, the optimum utilization will depend on the existence of an internal R & D capacity in the companies.

At a regional level, we must advance towards the establishment of a network of networks that will connect interactively the various actors of the national innovation system between themselves and with their networks of connection of emigrated scientists and engineers. It is important to emphasize that by extending the geographic dimension of the cooperation programs with scientists and engineers of Latin America residents within and outside the region the process of regional integration is being reinforced and a higher cooperation potential is made available to its economic and social development.

The Role of the State in the Creation and Consolidation of Global Cooperation Networks for Innovation

The State is called to satisfy certain market deficiencies in countries of little development related to the size of the markets, the availability of the risk capital, the formation of human resources and the disclosure of technologies, specially in the early stages of the development of a country when there is a high degree of dependency on foreign technologies.

The degree of disclosure of the new technologies depends on the availability of a minimal endogenous technological capacity, supported by a single component of basic and applied science, which will permit in a later stage to pass from the simple imitation to the creation of proper technologies. The participation by the State is fundamental in the creation of this capacity of S & T, not only by contributing the resources necessary to create the research infrastructure but by promoting the establishment of sectorial networks of innovation that will establish synergetic relations between the agents of the different sectors involved in the creation, disclosure and use of the technologies as a function of the social well being.

As it is taught by the recently industrialized countries of Asia, the State plays a determinant role in the promotion and consolidation of global networks of cooperation for innovation through highly selective support and motivation policies in exchange for the fulfillment of commitments established in the agendas and the assessment of results, generally measured by the increase of its exports (Deyo, 1992).

The States may themselves support the networks to accelerate the disclosure process by the creation of markets for certain foreign technologies, helping the potential users, generally small and medium size companies, to identify the benefits that their use may represent for them. Various experiences, such as those carried out by the Fundacion Chile, have shown that these policies may give better results if they are supported as " demonstrative experiences " that will increase the trust of the possible users.

The Regional Program of Academy of Sciences of Latin America (ACAL) and the Global Networks of Cooperation for Innovation in Latin America and the Caribbean

The Academy of Sciences of Latin America (ACAL) carries out since 1987 a Regional Cooperation Program oriented to promote the formation of cooperative research networks with the participation of scientists and engineers from Latin America who live within and outside the region. For such a purpose, the ACAL discloses information on scientific activities taking place in the region, supports the performance of courses and workshops and brings support to regional thematic networks in Biology, Chemistry, Physics, Mathematics, Geoscience and Astronomy. Recently, the ACAL has started the periodical holding of meetings of experts on important subjects of scientific policies called ACAL Forum, the first one of which, held in Caracas at the end of 1993, dealt with Regional Scientific Cooperation (Villegas and Cardoza, 1995).

On the other hand, ACAL, ALAS and UNESCO have joined their efforts to create a Data Base on Scientists, Engineers and Highly Qualified Personnel of Latin America and the Caribbean with residences outside the region as the first phase for the creation of the Global Network of Cooperation for the Innovation in Latin America and the Caribbean. With this purpose a monitoring and follow up unit has been created, which in addition to identifying the qualified human resources emigrated, creates information systems and establishes the contacts necessary to properly channel the actions oriented to the return and connection. Through this project an attempt is made to concrete the proposal by the ACAL to establish a Global Scientific Community of Latin America and the Caribbean that will permit to connect the researchers who live outside the region to various scientific and technological projects of the public and private sectors. The objective is that the data base becomes a useful instrument for the encouragement of cooperation through the promotion of activities where emigrated scientists and technologists will participate, such as : joint research projects, postgraduate studies, workshops, information exchange and human ressources training.

At the present time, the efforts are concentrated in the identification of the researchers of a Latin American and Caribbean origin who work in research centers of the industrialized countries and in the creation of the data base. As a concrete result we can mention that with the information gathered, the ACAL has created a distribution list in the Reacciun Network of CONICIT of Venezuela through which it discloses its quarterly bulletin Science in Latin America.

In the following stage, taking advantage of the facilities offered by the headquarters of Unesco in Paris and the Reacciun Network of Venezuela, on line access will be offered to the data base through the telematic networks. In the same way, information services will be designed and put in operation for the researchers identified about the scientific, technologic and educational cooperation programs carried out by the national institutions and international organizations.

For the development of these activities with the participation of government, non government and scientific organizations, the institutional support on the part of the national organizations of S & T (ONCYT's) becomes necessary.

In order to promote regional scientific cooperation and to supplement national programs of return and involvement of emigrated scientists and engineers, we are proposing the creation of a Regional Fund for the Scientific and Technical Cooperation financed basically with contributions by national S & T organizations (ONCYT'S) and aiming at the consolidation of the Global Networks of Cooperation for the Innovation. This fund would be used to promote exchanges and participation of emigrated scientists in programs of educational, scientific, technical and industrial cooperation oriented to create the basis for a new development model in Latin America.

Recommendations and Conclusions

The concentration of the commercial, financial and technological exchanges in a small group of developed countries characterizes the current process of 'excluding globalization'and determines substantial changes in the conditions for the competitive insertion of the developing countries economies at an international level. Except for China and the recently industrialized asian countries, the remaining developing countries are loosing importance as receivers of direct investments and of aggregated flows of technology, limiting their possibilities for economic and social development.

On the other hand, it should be expected that the recent processes of internationalization and liberalization of the economies of the region increase the competitive pressures exercised by foreign companies on local markets and that the companies seeking to increase their share in the international markets are committed to create competitive advantages on a strong scientific and technological basis. The evolution that can be anticipated indicates that the companies must create in the next few years internal R & D capabilities and increase the demand for S & T services for which highly qualified human resources are required. However, the Latin American countries show an increasing emigration of highly qualified scientists and professionals which implies losses for the society in general - very difficult and costly to recover - and hampers their possibilities to get out of the crisis and generate growth.

In Latin America the economic structural imbalances represent the main factor that causes migrations, and for this, the permanent solution to the exodus of talents is associated not to the implementation of isolated programs but to the adoption of policies of retention, involvement and return of human resources in full agreement with the goals established in the long term economic and social development plans that tend to eliminate these sources of imbalance. To this respect, the phenomenon of migration must be observed as a symptom of the problems that present the institutions and the society in general and its analysis must be utilized to diagnose and suggest solutions to the structural maladjustments that originate it.

The efforts of the States must be oriented preferentially to the definition and execution of retention and settlement policies. These must be supported by increasing investments for the creation and maintenance of the S & T capacity and in the adoption of systems of incentives and compensations that will motivate the scientists and engineers to stay notwithstanding the considerable differences of salaries that occur in the developed countries. It is also a fundamental task to develop research lines connected to the problems of economic and social development presented by the countries of Latin America. For this purpose, the systems of assignment of

resources must take into consideration the financing of those areas of research with a great scientific potential (natural resources, biodiversity, environment, etc.) where the region offers evident 'comparative advantages'. According to the need to reestablish economic growth and modify the international insertion based on competitive businesses, it becomes indispensable that the countries advance in the specialization of research concentrating their scarce human and financial resources on those areas that offer greater possibilities to obtain applicable results. The success of these policies will depend on the capacity for concentration among the public, private and scientific sectors and on the degree of conviction that the political sector would have on the contribution that S & T may make to the development of their countries.

In regards to the return and involvement of emigrated scientists the creation of Global Cooperation Networks for Innovation will engage the emigrated scientists and engineers of Latin American origin in projects that will favor the exchange of knowledge and of technologies. These networks represent a valuable instrument, specially in view of the growing barriers in the access to knowledge, to carry out plans of formation of human resources, joint research projects, actions of transfer of technology, acquisition of patents, execution of license agreements, execution of strategic alliances and delocalisation of R & D infrastructures on the part of transnational groups.

The adequate operation of the Global Cooperation Networks for Innovation requires the adoption of efficient policies and the coordination among all public and private organizations that participate in the National Innovation Systems (NIS) : industries, ministries responsible for the industrial development, education and infrastructure, the organizations responsible for the S & T policies, the research centers and universities, professional trades and association of industrialists.

Notwithstanding the importance, for the developing countries, of having national programs mobilizing scientists and engineers abroad, it is necessary to insist on the fact that the challenge of the societies of Latin America continues to be to create the economic, political, social and cultural conditions that will permit to develop and consolidate our scientific and professional communities. In other words, the challenge that we must face in the next few years consists in attacking the causes that generate the loss of qualified human resources by migration and to promote their settlement and optimal utilization for the benefit of the development of the Latin American nations.

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[1] Meyer and Charum (1994) in their criticism to the economicist and mechanicist approaches of migrations of talents point out that " the market or any macro-structure can not give an account simply of the circulation of competences ; this circulation is carried out through cognitive, material human relations with specific configurations, where it may be observed with what actors, how and why the migratory process takes place. "

Migraciones científicas, redes de cooperación y desarrollo en América Latina y el Caribe

Guillermo Cardoza
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Crisis, migraciones y reestructuración económica

La reciente crisis económica de América Latina, la más severa y prolongada de la historia de la región, caracterizada por la declinación de la productividad y una mayor vulnerabilidad frente a las perturbaciones externas, puso en evidencia el agotamiento de la estrategia de industrialización por sustitución de importaciones, la débil inserción internacional de los países de la región y la incapacidad de los Estados para afrontar eficientemente la crisis. Adicionalmente, el rápido avance de las tecnologías de producción y las nuevas condiciones de competencia que prevalecen en el comercio internacional han conducido a una rápida erosión de las ventajas comparativas que presentan los países de América Latina en razón de la abundancia de sus recursos naturales y del bajo costo de su mano de obra (Cardoza y Villegas, 1996).

De acuerdo a los datos del Banco Interamericano de Desarrollo (BID, 1993), los países de América Latina registraron descensos de la tasa media de crecimiento anual del producto interno bruto (PIB) por habitante (de 3,3 % a -1.1 %) y en la tasa media de crecimiento anual de la inversión interna bruta (de 7,2 % a -3,0 %) de la década de los 70 a la de los 80. Simultáneamente, durante la década de los 80 algunos países alcanzaron tasas medias anuales de inflación de tres dígitos.

Como respuesta para mejorar su inserción en la economía mundial y retomar la vía del crecimiento económico y social, los países de América Latina están adelantando reformas estructurales, centradas en la reestructuración productiva y la apertura de sus economías, que les permitan alcanzar la estabilización macroenconómica, elevar la competitividad de sus empresas y revertir el peso de la herencia del antiguo modelo de desarrollo.

Sin embargo, como ya hemos indicado, el éxito de estas reformas puede verse comprometido debido a que a los efectos perversos de la transferencia de recursos financieros por concepto de la deuda externa se suma ahora la migración de científicos y profesionales hacia los países industrializados. Ciertamente, la superación de las barreras estructurales que mantienen en el atraso a la región y determinan un patrón de inserción empobrecedor en un contexto internacional altamente competitivo exige la adopción de un modelo económico intensivo en conocimientos que permita aprovechar las oportunidades que ofrece la globalización. Para lograr este propósito, además de considerables inversiones, es preciso garantizar la participación de los científicos, ingenieros y demás profesionales de alta calificación, parte importante de los cuales ha emigrado hacia los países desarrollados.

La carencia de estadísticas completas y detalladas sobre el fenómeno migratorio dificulta el análisis y la evaluación de su impacto en el desarrollo de los países de América Latina. Estimaciones hechas por Alvarez (1993) con base en datos suministrados por el Servicio de

Información y Naturalización de los Estados Unidos de América señalan que en las tres décadas comprendidas entre 1961 y 1990 emigraron aproximadamente 500.000 profesionales y personal de alta calificación de los países la región hacia los Estados Unidos de América. Es legítimo esperar que se haya acentuado esta tendencia con la agudización de la crisis económica durante los años 90 por cuanto se han reducido las inversiones productivas generadoras de empleo y se han hecho recortes importantes en los presupuestos de Investigación y Desarrollo (I & D) en algunos países de la región. Si además tenemos en cuenta el déficit de científicos e ingenieros que se ha pronosticado en algunos países desarrollados y las políticas de inmigración selectivas implementadas en ellos para subsanarlos, es previsible que estos flujos migratorios se hayan intensificado y se continúen acentuando en los años próximos.

La globalización excluyente y el exodo de talentos

La marginación progresiva de los países de América Latina en los intercambios comerciales a nivel mundial y su pérdida de importancia como receptores de inversiones extranjeras directas (IED) y de flujos de tecnología, definen con claridad los contornos del proceso de 'globalización excluyente'en curso. En 1950 las exportaciones de América Latina representaban el 12.4 % del total mundial y sus importaciones se situaban en el 10.1 % en tanto que para 1990 estas cifras cayeron hasta el 3,6 % y el 4,3 % respectivamente. Esta situación es más grave aún, si tenemos en cuenta el progresivo deterioro de los términos del intercambio para los principales bienes primarios de exportación y que, a pesar del incremento en las exportaciones de manufacturas, la estructura de intercambio continúa basada en la exportación de materias primas y bienes intermedios de escasa transformación.

La participación de América Latina como región receptora de las inversiones extranjeras directas (IED) para los países en desarrollo cayó del 12.3 % para el período 1980-84 hasta el 5.8 % para 1988-89. Se aprecia igualmente que América Latina como región está siendo desplazada gradualmente por los países del Asia como receptora de IED destinadas a los países en desarrollo.

Igualmente, en relación a los flujos de tecnología hacia los países en desarrollo puede apreciarse que se distribuyen desigualmente y que los mismos tienden a concentrarse en los países asiáticos recientemente industrializados. Como lo señala la Organización de Cooperación y Desarrollo Económicos (OCDE, 1992), agrava aún más la situación la adopción de regímenes de propiedad intelectual que restringen el acceso de los países en desarrollo a las tecnologías que necesitan para incrementar su competitividad y sentar las bases de un modelo de crecimiento económico y social más justo.

La crisis impone además severas restricciones a los países de la región para incrementar sus inversiones y sus presupuestos de educación y de I & D. Varios países (Bolivia, Chile, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, México y Venezuela) tuvieron un importante descenso en el gasto en educación, expresado como porcentaje del PIB, entre 1980 y 1990. Así mismo, puede observarse que para ningún país el gasto en I & D alcanzó el 1 % del PIB y por el contrario países como Guatemala, Ecuador, México y Paraguay registraron descensos en este indicador durante los años 80. Adicionalmente, la mayoría de los países sufrieron importantes reducciones en el ingreso per capita y en la inversión interna bruta durante el mismo período.

El conjunto de estos factores, causantes de la crisis económica, política y social de los países de la región, determina también la creciente migración de profesionales y personal de alta calificación. El número estimado de profesionales y personal de alta calificación emigrados de América Latina hacia los Estados Unidos se mantiene creciendo desde los años 60.

El exodo de talentos y las politicas de retención y retorno

Durante las décadas de los 60 y los 70 se observó una preocupación creciente por el fenómeno de la fuga de cerebros, lo que motivó su inclusión como tema central en la agenda de discusiones de distintos organismos internacionales. El United Nations Institute for Training and Research (UNITAR) publicó estudios sobre la emigración de personas de alta calificación desde los países en desarrollo (Henderson, 1970 ; UNITAR, 1971 ; Glaser, 1978). Por su parte, la Conferencia de Naciones Unidas sobre Comercio y Desarrollo (UNCTAD, 1974, 1975) encargó distintos estudios acerca de la 'transferencia inversa de tecnología'y su impacto económico sobre los países en desarrollo. Así mismo, diversos trabajos fueron realizados por encargo de la UNESCO sobre la emigración de científicos y tecnólogos (McKingth, 1971 ; SPD, 1968). También en campos específicos como el de las ciencias de la salud se prepararon informes sobre la migración de profesionales (WHO, 1974, 1975, 1976).

Estos estudios sobre la migración de talentos se centraron en la identificación y análisis de los factores y motivaciones que determinan las migraciones y en las políticas para contrarrestarlas. En diferentes grados de profundidad los estudios tomaron en cuenta variables tales como los diferenciales de ingresos entre los países desarrollados y los países en desarrollo y el desbalance entre el exceso de científicos y profesionales formados y la limitada capacidad de absorción de los mercados locales de trabajo (Grubel y Scott, 1977 ; Glaser y Habers, 1978). De igual manera, estos trabajos también señalaron que los flujos migratorios de personas de alta calificación están determinados por las necesidades de recursos humanos propias de los ciclos de crecimiento económico de los países desarrollados.

Los análisis coinciden en señalar como causas de las migraciones de científicos e ingenieros entre otras : la falta de sistemas de remuneración que valoren adecuadamente los títulos o niveles de formación y la experiencia de estos profesionales ; la carencia de infraestructuras adecuadas y, la falta de masas criticas que permitan romper el aislamiento. Al respecto, se anota que la carencia de posibilidades de actualización en los campos de frontera y de eficientes sistemas de comunicación generan un progresivo aislamiento de los investigadores que sólo es posible romper, *ceteris paribus*, emigrando hacia los países desarrollados que además de buenas remuneraciones ofrecen estabilidad laboral, sistemas de promoción basados en criterios de productividad y eficiencia y lo más importante, entornos o climas intelectuales propicios y estimulantes para la labor creativa (Villegas y Cardoza, 1993). Refiriéndose al éxodo de los científicos Dedijer (1962) anotaba que « es sólo un síntoma de las condiciones relativamente ilógicas para el desarrollo de la ciencia ».

De otra parte, se han considerado políticas orientadas a contrarrestar el éxodo de talentos que van desde la implementación de restricciones a la salida con base en leyes nacionales sobre la inmigración y visados hasta la aplicación de un impuesto a los profesionales que emigran hacia los países industrializados y la creación de esquemas intergubernamentales de compensación a los países en desarrollo por la pérdida de sus recursos humanos calificados (Bhagwati y Partington, 1976 ; Grubel y Scott, 1977).

Además del estudio de las determinantes del fenómeno migratorio, se han propuesto modelos teóricos para el análisis de los aspectos económicos de los flujos migratorios internacionales de personal de alta calificación y de su impacto sobre el bienestar de las sociedades de los países de origen de los emigrados (Grubel y Scott, 1977). En los análisis cuantitativos de la migración se han utilizado distintos enfoques, tales como : la evaluación del ahorro que representa para el país receptor del inmigrante calificado ; las estimaciones del valor presente del capital humano de los migrantes con base en ingresos futuros esperados ; los costos asociados a la pérdida de bienestar de la población de origen de los migrantes y las pérdidas asociadas a la reducción en los ahorros y en la captación de impuestos debido a las migraciones [1].

Las recomendaciones que aportan estos estudios en relación a las políticas de retorno y retención de los científicos e ingenieros continúan siendo válidas para la mayoría de los países de América Latina. Como señala el Comité Intergubernamental para las Migraciones (CIM, 1985), los programas para fomentar la migración de retorno de recursos humanos calificados « deberían concentrarse en objetivos bien definidos, entre ellos provisión de vacantes específicas en puestos de alto nivel, criterios de contratación sumamente selectivos, y reconocimiento de la necesidad de condiciones de empleo atractivas, con inclusión de asistencia financiera, material y psicosocial ».

Para garantizar su eficiencia, los programas de recuperación y retención de los recursos humanos calificados deben contemplar además, la oferta de recursos para financiar las salidas de los investigadores a los laboratorios de colegas donde recibirán el entrenamiento necesario para su actualización y en muchos casos, debido a la carencia de infraestructuras adecuadas, la posibilidad de adelantar parte de sus investigaciones. Así mismo, se recomienda que se debe procurar un adecuado balance entre su labor científica y las actividades de docencia y administración para garantizar que puedan dedicar suficiente tiempo a consolidar su carrera en un medio internacional altamente competitivo. Pendersen (1988) agrega al respecto que los incentivos a los que regresan deben incluir entre otros, oportunidades de desarrollo personal, mecanismos para mantener contactos internacionales, ofertas de soluciones de vivienda y sistemas de reconocimiento y status sociales.

Respecto de la retención o arraigo de los recursos humanos de alta calificación, en la evaluación realizada por COLCIENCIAS del Programa de Retorno de Profesionales de Colombia (Decreto 1397 de 1972), Cardona et al. (1980) señalaban que « más importante que repatriar a quienes ya han emigrado, es retener a los emigrantes potenciales ». Ciertamente, además de desarrollar un mercado interno de trabajo para los investigadores con salarios competitivos e infraestructura física adecuada, es preciso avanzar en la creación de la masa crítica de investigadores preferencialmente en aquellos campos en los cuales se pueda hacer un mejor aprovechamiento de la dotación de factores. En este proceso, la cooperación de los científicos e ingenieros residentes en América Latina con los investigadores de la región que trabajan en los países desarrollados constituye un importante elemento a ser considerado en el diseño de las políticas de desarrollo científico, tecnológico e industrial.

De la perdida (brain drain) a la cooperación (brain gain) Las ventajas de la cooperación con los científicos e ingenieros emigrados

A diferencia del énfasis que se ha colocado en el ‘brain drain’y la ‘repatriación de los fugados’como elementos centrales en las políticas nacionales relativas a las migración de talentos, ahora se sugiere adoptar un enfoque más pragmático basado en el concepto de ‘brain gain’ [2] que promueva el aprovechamiento del potencial de cooperación científica y técnica asociado a la vinculación de los científicos e ingenieros emigrados.

En principio, los científicos e ingenieros vinculados a centros de investigación y empresas públicas y privadas de los países industrializados pueden desempeñar un papel de importancia en la construcción de una capacidad endógena de I & D en sus países de origen a través de su contribución a la formación de recursos humanos para I & D, facilitando el acceso a sistemas de información y promoviendo la realización de proyectos conjuntos de investigación.

Debido a las posiciones que ocupan gran parte de los profesionales migrados que trabajan en los centros de excelencia académica de los países desarrollados también es posible encontrar asesoría para la creación de postgrados en aquellas áreas en las cuales los países de la región requieran profesionales e investigadores de alta calificación. Así mismo, los colegas emigrados estarían en capacidad de ofrecer distintas posibilidades de cooperación educativa y científica : programas de formación a nivel de doctorado o postdoctorado para estudiantes de la región ; entrenamiento de corta duración en temas específicos y asesorías en la formulación, evaluación y ejecución de proyectos de investigación ; pasantías y años sabáticos para dictar cursos ; co-tutorías de trabajos de grado. En general, las relaciones de vinculación con los académicos emigrados pueden conducir a acuerdos interinstitucionales para la formación y entrenamiento de recursos humanos.

La experiencia de los científicos, ingenieros y demás profesionales emigrados en el uso de nuevas tecnologías y sus relaciones profesionales constituyen también recursos de gran valor en el proceso de formulación y evaluación de políticas para la transmisión de know-how y la difusión de tecnologías, y en el asesoramiento a las instituciones y empresas en el proceso de incorporar tecnologías extranjeras para el aumento de su competitividad internacional. En efecto, a nivel de los procesos de modernización industrial los profesionales emigrados pueden prestar su colaboración para traducir las necesidades de los usuarios en términos tecnológicos. Su asesoría puede extenderse desde la búsqueda y apropiada selección de las tecnologías, hasta la negociación para su adquisición y las modalidades de transferencia. Más adelante sus servicios son fundamentales para garantizar, en conjunción con el personal local, la asimilación, adaptación y eventualmente el cambio y creación de nuevas tecnologías.

Por otro lado, los profesionales emigrados pueden ofrecer asesorías en ingeniería y diseño necesarias para apuntalar los procesos de modernización productiva que se adelantan en la región. Su asistencia puede facilitar tanto el acceso y la asimilación de las tecnologías avanzadas de manufactura como la introducción del nuevo paradigma de organización de la producción. Diversas metodologías y técnicas organizativas y gerenciales (círculos de calidad, calidad total, ingeniería reversa, manejos de inventarios, just-in-time, etc.) pueden ser más rápida y eficientemente transferidas y asimiladas con la ayuda de los profesionales de América Latina residenciados en los países desarrollados (Cardoza, 1994).

Como podemos apreciar, la vinculación de los científicos, ingenieros y personal de alta calificación emigrados puede representar un aporte fundamental para la creación de las redes de transferencia y acumulación de conocimiento necesarios para desarrollar una metodología de aprendizaje del desarrollo tecnológico en los países de la región. Es conocido, que estas nuevas modalidades de cooperación científica y tecnológica constituyen una fuente privilegiada en el proceso de ‘aprender a innovar’.

Sin embargo, el aprovechamiento óptimo de esta fuente de cooperación técnica y científica, representada por la vinculación de los emigrados, depende precisamente de la capacidad de crear y operar estructuras que los vinculen no sólo con sus colegas sino que promuevan el establecimiento de relaciones con todos los actores involucrados en los procesos de innovación a nivel nacional y regional.

De la diáspora a la red de cooperación científica y tecnológica

Las nuevas tecnologías de telecomunicaciones, en especial la Comunicación Mediante Computador, hacen posible la acelerada transformación del ‘colegio invisible’, caracterizado por la relación esporádica e informal de los investigadores, hacia el colegio electrónico global

estructura cimentada en las redes telemáticas que permiten la interacción fluida y sistemática de investigadores que trabajan en un mismo tema o en campos relacionados.

Como consecuencia del uso masivo de las nuevas tecnologías de comunicación, se comienzan a apreciar cambios importantes tanto en el método de trabajo de los investigadores como en las modalidades de cooperación. El bajo costo de las comunicaciones y la alta velocidad de transmisión facilitan el intercambio fluido de información entre colegas que trabajan en áreas comunes y el surgimiento de redes de cooperación entre investigadores.

La emergencia de esta nueva sociedad científica global permite romper con el aislamiento de los investigadores en los países en desarrollo, señalada como una de las principales causas del éxodo de talentos. Las posibilidades de interacción que ofrecen las redes electrónicas entre los investigadores de los países de la región y sus colegas residenciados fuera de ella facilita la formación de masas críticas virtuales y el establecimiento de relaciones cooperativas de investigación que contribuyen a arraigar los investigadores residentes en América Latina a sus países (Cardoza, 1993).

En la actualidad, la telemática facilita el proceso de identificación y la puesta en marcha de programas de vinculación de los profesionales emigrados a proyectos relevantes para el desarrollo de sus países de origen y de la región misma. De esta manera, la noción de científicos e ingenieros nacionales en el extranjero permite dar concreción al concepto de Comunidad Científica Global de América Latina propuesto anteriormente (Villegas y Cardoza, 1993 ; Cardoza y Villegas, 1996). En efecto, allí planteamos la posibilidad de desarrollar un ambicioso programa de cooperación científica internacional con base en el papel que pueden desempeñar estos profesionales residenciados fuera de la región. A partir de esta comunidad ampliada o extendida, que trasciende las fronteras nacionales y regionales, se pueden diseñar políticas de desarrollo tecnológico y económico basadas en una red de cooperación que funcione como una ‘ventana abierta’a las tecnologías disponibles y las oportunidades que ofrecen los mercados internacionales.

Los Sistemas Nacionales de Innovación (SNI) y las redes globales de cooperación para la innovación

Con el propósito optimizar las actividades de cooperación y hacer eficientes los procesos de difusión, asimilación y adaptación de las tecnologías, propias e importadas, se ha recomendado constituir Sistemas Nacionales de Innovación (SNI) (Freeman, 1987 ; OCDE, 1992) donde participen las instituciones de los sectores público y privado relacionadas con el proceso de innovación. En esta red deben participar las universidades e instituciones públicas de Ciencia y Tecnología (C & T), los laboratorios de I & D de las industrias, las instituciones de educación y adiestramiento, los centros de ingeniería y diseño y las instituciones nacionales responsables de las políticas científicas y de la coordinación con el sector empresarial.

El buen desempeño de los SNI depende del establecimiento de políticas de C & T en concordancia con las políticas económicas y sociales que contempla el plan nacional de desarrollo. Así mismo, este plan debe señalar en lo posible la contribución que la C & T puede hacer para alcanzar los objetivos de corto, mediano y largo plazo definidos para cada uno de las grandes áreas de desarrollo (agricultura, salud, energía, ambiente, empleo, etc.). El establecimiento de las prioridades y la asignación de los recursos debe ser el resultado de diálogos consensuales que consideren tanto las necesidades como los aportes reales y potenciales de todos los actores del proceso de innovación.

En la actualidad, los SNI deben afrontar el reto que les plantea la globalización e internacionalización de las actividades de creación del conocimiento y difusión de tecnologías. En este sentido, la incorporación de los científicos e ingenieros residentes fuera de la región a los SNI permite 'extender'estos sistemas y crear Redes Globales de Cooperación para la Innovación que garanticen una amplia diseminación del conocimiento y una progresiva endogenización de las actividades de innovación tecnológica, organizacional e institucional. Como lo señalan Justman y Teubal (1995) estas actividades apuntan a fortalecer el proceso de 'learning from cooperation'.

Las nuevas modalidades de cooperación que resultan de las diversas acciones 'vinculativas'reclaman la creación de entornos favorables para su pleno desarrollo operativo. Se precisa de un marco institucional estable y de equipos promotores altamente motivados que dispongan de eficientes sistemas de información y unidades estratégicas de especialistas encargados del establecimiento de prioridades, la asignación de los recursos y la evaluación de las actividades. De igual manera, el éxito de estas iniciativas depende de la capacidad de los SNI de transformar los vínculos y contactos personales de los investigadores en redes especializadas y en acuerdos de cooperación inter-institucionales.

A nivel de la cooperación técnico-industrial es deseable que las redes globales de cooperación para la innovación den origen a subredes sectoriales especializadas que permitan a grupos de usuarios potenciales de determinada tecnología compartir los riesgos y costos asociados a su importación y adaptación. Estas subredes pueden también compartir infraestructuras de información y formación de recursos humanos. En cualquier caso, como lo señala Stewart (1995), la capacidad de un país para aplicar C & T desarrollada en otros países depende del mantenimiento de un nivel de experiencia investigativa. En efecto, a nivel industrial el aprovechamiento óptimo dependerá de la existencia de una capacidad intramuros de I & D en las empresas.

A nivel regional, debemos avanzar hacia la constitución de una red de redes que vincule interactivamente los diversos actores de los sistemas nacionales de innovación entre si y con sus redes de vinculación de los científicos e ingenieros emigrados. Es importante destacar que al ampliar la dimensión geográfica de los programas de cooperación con los científicos e ingenieros de América Latina residentes dentro y fuera de la región se está reforzando el proceso de integración regional y se pone a disposición de su desarrollo económico y social un mayor potencial de cooperación.

El papel del Estado en la creación y consolidación de las redes globales de cooperación para la innovación

El Estado esta llamado a suplir ciertas deficiencias del mercado en países de escaso desarrollo relacionadas con el tamaño de los mercados, la disponibilidad de capital de riesgo, la formación de recursos humanos y la I & D. La intervención del Estado es decisiva para dinamizar el proceso de asimilación y difusión de tecnologías, especialmente en etapas tempranas de desarrollo de un país cuando se depende en alto grado de las tecnologías extranjeras.

El grado de difusión de las nuevas tecnologías depende de la disponibilidad de una capacidad tecnológica endógena mínima, sustentada en un sólido componente de ciencia básica y aplicada, que permita en una etapa ulterior pasar de la imitación a la creación de tecnologías propias. La participación del Estado es fundamental en la creación de esta capacidad de C & T, no sólo aportando los recursos necesarios para crear la infraestructura de investigación sino promoviendo la constitución de redes sectoriales de innovación que establezcan relaciones sinér-

gicas entre los agentes de los diferentes sectores involucrados en la creación, difusión y uso de las tecnologías en función del bienestar social.

Como lo enseñan los países recientemente industrializados de Asia, el Estado juega un papel determinante en la promoción y consolidación de las redes globales de cooperación para la innovación a través de políticas de apoyo y estímulo altamente selectivas a cambio del cumplimiento de compromisos fijados en las agendas y la evaluación de los resultados, generalmente medidos por el aumento de sus exportaciones (Deyo, 1992).

Los Estados pueden apoyarse en las redes para acelerar el proceso de difusión mediante la creación de mercados para determinadas tecnologías extranjeras, ayudando a los usuarios potenciales, generalmente pequeñas y medianas empresas, a identificar los beneficios que puede representar para ellos su utilización en sus empresas. Diversas experiencias, como las adelantadas por la Fundación Chile, han demostrado que estas políticas pueden dar mejores resultados si están apoyadas en 'experiencias demostrativas' que aumentan la confianza en los posibles usuarios.

El programa regional de la ACAL y las redes globales de cooperación para la innovación

La Academia de Ciencias de América Latina (ACAL) adelanta desde 1987 un Programa de Cooperación Regional orientado a promover la formación de redes cooperativas de investigación donde participan los científicos e ingenieros de América Latina que residen dentro y fuera de la región. A tal efecto, la ACAL difunde información sobre las actividades científicas que tienen lugar en la región, apoya la realización de cursos y talleres y ofrece apoyo a las redes temáticas regionales de Biología, Química, Física, Matemáticas, Geociencia y Astronomía. Recientemente la ACAL ha iniciado la realización periódica de reuniones de expertos sobre temas importantes de política científica denominadas *Foro ACAL*, el primero de los cuales, realizado en Caracas a fines de 1993, trató sobre la Cooperación Científica Regional (Villegas y Cardoza, 1995).

Por otra parte, ACAL, ALAS y UNESCO han unido sus esfuerzos para crear una Base de Datos sobre Científicos, Ingenieros y Personal de Alta Calificación de América Latina y el Caribe residenciados fuera de la región como primera fase para la creación de la Red Global de Cooperación para la Innovación en América Latina y el Caribe. Con este propósito se ha creado una unidad de monitoreo y seguimiento que además de identificar los recursos humanos calificados emigrados, crea sistemas de información y establece los contactos necesarios para canalizar adecuadamente las acciones orientadas al retorno y a la vinculación. A través de este proyecto se intenta dar concreción a la propuesta de la ACAL de constituir una Comunidad Científica Global de América Latina y el Caribe que permita vincular a los investigadores residenciados fuera de la región a diversos proyectos científicos y tecnológicos del sector público y privado. Se aspira entonces a que la base de datos se constituya en un instrumento útil al fomento de la cooperación a través de la promoción de actividades donde participen los científicos y tecnólogos emigrados, tales como : proyectos conjuntos de investigación, cursos de postgrado, talleres de trabajo, intercambios de información y ofertas de formación de recursos humanos.

En el presente, los esfuerzos se concentran en la identificación de los investigadores de origen latinoamericano y caribeño que trabajan en los centros de investigación de los países industrializados y en la creación de la base de datos. Como resultado concreto podemos mencionar

que con la información recolectada, la ACAL ha creado una lista de distribución en la Red Reacciun del CONICIT de Venezuela a través de la cual difunde su boletín trimestral *Ciencia en América Latina*.

En la etapa siguiente, aprovechando las facilidades que ofrece la sede de Unesco en París y la Red Reacciun de Venezuela, se ofrecerá el acceso en línea a la base de datos a través de redes telemáticas. De igual manera, se diseñarán y pondrán en funcionamiento servicios de información para los investigadores identificados sobre los programas de cooperación científica, tecnológica y educativa que adelantan las instituciones nacionales y los organismos internacionales. Para el desarrollo de estas actividades en las que participaran organismos gubernamentales, no gubernamentales y las mismas organizaciones de científicos, se hace necesario el apoyo institucional por parte de los organismos nacionales de C & T (ONCYT's).

Con el propósito de promover la cooperación científica regional y complementar los programas nacionales de retorno y vinculación de los científicos e ingenieros emigrados, estamos proponiendo la creación de un Fondo Regional para la Cooperación Científica y Técnica financiado fundamentalmente con aportes de los organismos nacionales de C & T (ONCYT's) destinado a la consolidación de la Redes Globales de Cooperación para la Innovación. Este fondo se utilizaría para promover los intercambios y la participación de científicos emigrados en programas de cooperación educativa, científica, técnica e industrial orientados a crear las bases de un nuevo modelo de desarrollo de América Latina.

Recomendaciones y conclusiones

La concentración de los intercambios comerciales, financieros y tecnológicos en un pequeño grupo de países desarrollados caracteriza el actual proceso de 'globalización excluyente'y determina cambios sustanciales en las condiciones para la inserción competitiva de las economías de los países en desarrollo a nivel internacional. A excepción de China y los países asiáticos recientemente industrializados, los demás países en desarrollo registran una pérdida de importancia como receptores de inversiones directas y de los flujos agregados de tecnología, lo cual limita sus posibilidades de desarrollo económico y social.

Por otro lado, es de esperar que los recientes procesos de apertura y liberalización de las economías de la región aumenten las presiones competitivas ejercidas por las compañías foráneas en los mercados locales y que las empresas que buscan aumentar sus participaciones en los mercados internacionales se aboquen a crear ventajas competitivas de fuerte base científica y tecnológica. La evolución previsible señala que las empresas deberán crear en los próximos años capacidades intramuros de I & D y aumentar la demanda de servicios de C & T para lo cual se requieren recursos humanos de alta calificación. Sin embargo, los países de América Latina registran una creciente emigración de científicos y profesionales de alta calificación que implica pérdidas para el conjunto de la sociedad muy difíciles y costosas de recuperar y condiciona sus posibilidades de salir de la crisis y retomar el crecimiento.

En América Latina los desequilibrios estructurales de sus economías constituyen el principal factor desencadenante de las migraciones, por lo cual, la solución permanente al éxodo de talentos esta asociada no a la implementación de programas aislados sino a la adopción de políticas de retención, vinculación y retorno de los recursos humanos en plena concordancia con las metas fijadas en los planes de desarrollo económico y social de largo plazo que tiendan a eliminar estas fuentes de desequilibrio. En este sentido, el fenómeno de la migración debe ser observado como un síntoma de los problemas que presentan las instituciones y la sociedad en

general y su análisis debe ser aprovechado para diagnosticar y sugerir soluciones a los desajustes estructurales que lo originan.

Los esfuerzos de los Estados deben orientarse preferencialmente a la definición y ejecución de políticas de retención y arraigo. Estas deberán estar sustentadas en crecientes inversiones para la creación y mantenimiento de la capacidad de C & T y en la adopción de sistemas de estímulos y compensaciones que motiven a los científicos e ingenieros a permanecer a pesar de los considerables diferenciales de salarios que se presentan con los países desarrollados. También es tarea fundamental desarrollar líneas de investigación vinculadas a la problemática de desarrollo económico y social que plantean los países de América Latina. A tal efecto, los sistemas de asignación de recursos deben tomar en consideración el financiamiento de aquellas áreas de investigación con un gran potencial científico (recursos naturales, biodiversidad, ambiente etc.) donde la región ofrece evidentes 'ventajas comparativas'. Atendiendo a la necesidad de restablecer el crecimiento económico y modificar la inserción internacional con base en empresas competititivas, resulta entonces imprescindible que los países avancen en la especialización de la investigación concentrando sus escasos recursos humanos y financieros en aquellas áreas que ofrezcan mayores posibilidades de obtener resultados aplicables. El éxito de estas políticas dependerá de la capacidad de concertación entre los sectores público, privado y científico y del grado de convicción que el sector político tenga sobre el aporte que la C & T pueden hacer al desarrollo de sus países.

En lo que respecta al retorno y vinculación de los emigrados se propone la creación de Redes Globales de Cooperación para la Innovación que vinculen a los científicos e ingenieros de origen latinoamericano emigrados en proyectos que favorezcan el intercambio de conocimientos y de tecnologías. Estas redes representan un valioso instrumento, especialmente ante el incremento de las barreras de acceso al conocimiento, para adelantar planes de formación de recursos humanos, proyectos conjuntos de investigación, gestiones de transferencia de tecnología, adquisición de patentes, realización de acuerdos de licencia, celebración de alianzas estratégicas y deslocalización de infraestructura de I & D por parte de grupos transnacionales.

La adecuada operación de las Redes Globales de Cooperación para la Innovación requiere de la adopción de eficientes políticas y de la coordinación entre todos los organismos públicos y privados que participan en los Sistemas Nacionales de Innovación (SNI) : las industrias, los ministerios responsables del desarrollo industrial, de la educación y de la infraestructura, los organismos responsables de las políticas C & T, los centros de investigación y las universidades, los gremios profesionales y las asociaciones de industriales.

No obstante la importancia que representa para los países en desarrollo contar con programas nacionales de vinculación de científicos e ingenieros residentes fuera de la región, es preciso insistir en que el reto central de las sociedades de América Latina continua siendo crear las condiciones económicas, políticas, sociales y culturales que permitan desarrollar y consolidar nuestras comunidades científicas y profesionales. En otras palabras, el desafío que deberemos afrontar en los próximos años consiste en atacar las causas que generan la pérdida de los recursos humanos calificados por migración y promover su arraigo y aprovechamiento óptimo en beneficio del desarrollo de las naciones de América Latina.

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[1] Meyer y Charum (1994) en su crítica a los enfoques economicista y mecanicista de las migraciones de talentos señalan que « el mercado o cualquier macro-estructura no pueden dar cuenta simplemente de la circulación de las competencias ; esta circulación se realiza a través de relaciones humanas, cognitivas, materiales con configuraciones particulares, donde se puede observar con cuales actores, como y por qué se desarrolla el proceso migratorio. »

[2] El concepto de 'brain gain'ya era utilizado por Myers, 1966 y Dedijer and Svenningson, 1967. Su uso se restringía generalmente a las políticas de retorno de talentos emigrados.

In Contact with Venezuela CONICIT: Design Management and Assessment of Policies

Iván de la Vega

Frame of Reference

Venezuela is an atypical country in Latin America, the huge natural and economic resources that it has managed has permitted it to attract immigrants from various nationalities, basically in well defined waves, in the decade of the ‘50s and in the ‘70s, which have left an important legacy to the contemporaneous Venezuelan society, from the transfer of technology to the academic level.

To the contrary, the decade of the ‘80s, marks a new course for Venezuela ; 1983 the beginning of a regression in all the environments of society, that progressively deteriorates the level and the quality of life of the population. The problem presents a multiplicity of factors that when combined mark a delicate situation for the country ; the growth expectations of the Venezuelan society in the ‘70s and beginning of the ‘80s were huge, the artificial economy that generates the exponential increase of the prices of the barrel of oil (1979) increasing the income for this item, creates a situation of bonanza that tarnishes the outlook of most of the population.

The return of an important mass of immigrants in the last few years to their countries of origin, can be explained through a structural problem of the Venezuelan society. The lack of coherent long term policies, in addition to the corruption at all levels, have generated the above mentioned regression. Some indicators that permit to explain the problem are mentioned below.

The phenomenon of inflation with the consequent devaluation of currency was unknown in Venezuela. This process of decomposition of the economy -characterized by the dependence on oil- has become systematically worse, generating high unemployment indexes and a progressive deterioration of public utilities. The poverty indicators have reached percentages close to 80 % in its various forms ; the informal sector of the economy has growth disproportionately ; all of this had increased the levels of delinquency and school desertion, among others.

Circumscribing the problem to the Venezuelan scientific and technological dimension, the approaches that had oriented it were fundamentally based on the phenomenon and strengthening of research, as an isolated from the socio-economic context of the country. With the appearance of the economic and political events mentioned above, the need to restate the policies became evident, in order to expand the focalized vision of the different areas of action of man, in order to incorporate the scientific and technological items into the global dynamics of the society.

Within this new dimension, one of the immediate consequences of the socio-historical process of the last decade, is the unusual migration of Venezuelans abroad, specifically made up by researchers, with a high level of education who did not find adequate spaces for performance within our frontiers. It is widely known that the developed countries have well defined policies for attracting highly qualified professionals to incorporate them to their intellectual « stock » ; it is important to point out the opportunities offered by the universities and companies, in the process of almost unavoidable seduction for any scientist and/or technologist.

The emigration abroad of Venezuelan talent is a relatively new phenomenon, commonly called talent drain. To the extent that the crisis in the country has become more severe, it has lead the most qualified people to an exodus. The analysis must be centered on how to solve the situation, designing proper and efficient strategies that will cover the different actions that place the country in a situation of advantage, whatever the location of the Venezuelan talent. To achieve the connection of scientists and technologists in important positions in other countries, through well oriented programs to work in concrete projects for the resolution of problems of national interest, may become a favorable situation for Venezuela, even more so when the globalization is a tendency of the new world order.

Following are presented some indicators of the global perspective of scientists and technologists in the country :

International organizations such as UNESCO indicate that VENEZUELA should have about 20,000 researchers to be able to face the development with a better intellectual platform. Statistics indicate that there are a little over 4,000, which is less than 25 % of the mentioned standards. CONICIT recognizes within the PPI more than 1,050 qualified researchers of 2,307 registered for the year 1994. UNESCO recommends a minimum of 1 researcher per every 1,000 inhabitants. France has a ratio of 4 researchers for every 1,000 inhabitants, which indicates that Venezuela should have around 20,000 researchers.

Funding is an important factor. UNESCO indicates that every country should invest as a minimum 2 % of the GNP in research. South Korea invests 2 %, France 2.3 %, Japan and Germany 2.8 %, USA 2.6 %, and the Latin American Countries : Brazil 0.9 %, Mexico 0.4 % and Venezuela 0.4 %.

Another important indicator is the relief generation that is being educated and graduated from universities and higher institutes. Without making a deep analysis of the quality of such education, the official figures indicate that in the last few years there is a tendency of 1.6 % of students that graduate from the so called basic sciences (OPSU), which assumes a problem in the generational relief. Countries such as Costa Rica have figures in the last few years of 2.4 % of students who graduate from these careers.

Information on the phenomenon of researchers who retire or desert from the scientific and technological activities, indicate that there is a strong unbalance between the latter and those who enter research. The perspective for the next few years may become more serious if the tendencies are not rapidly corrected. The current retirement average of the most qualified personnel in Venezuelan universities is 26.5 % (XLIV Annual Convention of ASOVAC).

Venezuela could become even more behind the times than what it is now within the worldwide context. Its insertion within the accelerated process of technological explosion is imperative. For this purpose it must implement programs intended to the creation of human capabilities for research and innovation in the short term. Above all because it has a potential in its natural and human resources, more than with an installed capacity that should be utilized, taking into consideration the technological component in the productive sector.

Below are outlined different initiatives that are currently carried out in Venezuela to identify how many qualified Venezuelan people are abroad. The Polar Foundation is carrying out an exploratory study in order to detect these professionals and gather detailed information of their experience on a data base. The first census or report, gathers more than 250 scientists located abroad and specifically belonging to basic sciences and technological transfer, which are the areas of interest of that Foundation, at this time. Another important initiative that is underway in the country, but which incorporates Latin America, is the joint project of the Academy of Sciences of Latin America, the Regional Office of Science and Technology and the Latin American Association of scientists (ACAL-ORCYT-ALAS) ; they are implementing another data base. They also have an electronic newspaper that intends to cover all the professionals and even students abroad. For the month of March of the current year they had more than 400 included in their list by electronic mail and more than 200 by ordinary mail, since they do not have this tool.

The ambassador of Venezuela in UNESCO, Dr. Kerdel Vegas, is one of the precursors that is endeavoring to know how many professionals are outside the country. Part of his concern is how to connect them with the country and how they can help to solve problems inherent to their specialty. He has under his direction another data base which is financed by UNESCO and is framed within a worldwide project on migrations coordinated by the United Nations (ONU) which is called TOKTEN.

The mentioned figures are still incomplete to establish the outlook of the Venezuelan reality, but it could be pointed out that there is a situation that must be tackled at its different fronts :

- Situation caused by the continuous dismissals or separations by retired people.
- Low volume of professionals who take up research activities.
- Migration abroad of professionals educated for research activities in Science and Technology.
- Migration of professionals to the productive sector to hold positions different from research, without leaving in many cases the adequate relief. This by itself could be seen as a loss, but could also be observed as an opportunity, if adequately performed.
- The percentage of students with scholarships from the CONICIT, in the period 1990-1994, who did not return is of 8 %.

This is an expression of structural problems that are evidenced by the lack of tradition towards these activities, in contrast with the attractive that the same means in the developed countries.

Finally, it is necessary to mention the different initiatives that are carried out in other countries of the region such as Argentina, Mexico, Chile, Uruguay and mainly Colombia, with respect to getting in contact with the native professionals who are out of their countries. By means of well defined policies and strategies, in each one of them there are successful experiences on this subject, which must be studied in order to incorporate some elements that will be adapted to the PEREZ BONALDE program.

Objectives

General Objective

To encourage the Venezuelan talent resident abroad in order that it will contribute to the identification and utilization of the opportunities for international technical cooperation, which may be of interest to support the innovation processes in the country and to guarantee the subsequent benefits of this interaction, through the application of different strategies that will strengthen the acting of the researchers, from the best comparative advantages offered by them.

Specific Objectives

- To use the stay of the researchers abroad, as a point of contact for the mobilization of information and other factors that will facilitate associated activities, through the incorporation to national capabilities of modern and updated technological mechanisms ; improving the communication conditions and facilitating international relations.
- To create national conditions that will favor the research and technological development activities to avoid their migration.
-To create the organizational platform that will enable the final return of Venezuelan talent settled abroad.

Policy Guidelines

The general guidelines of the policy of the CONICIT that serve as a frame of reference for acting with respect to Venezuelan talent abroad are as follows :
- To favor an effort of articulation based on common national and international interest, as a function of the economic development and the quality of life of our society.
- To favor a culture of scientific and technological information that will facilitate the ties between the various actors of the country with Venezuelan experts settled in the rest of the world, using the multiple possibilities given by the telematic development, through the electric mail with its various modalities (telephone/fax, multimedia, video-conferences, among other technologies),
- To establish as priority the connection with Venezuelan students (mainly beneficiaries of scholarships) who are pursuing studies abroad.
- To establish as priority the connection of Venezuelans abroad who are in centers that offer international cooperation opportunities.
- To favor the development of mechanisms and instruments to strengthen those institutions that will facilitate the incorporation of Venezuelans for their final return.

Strategies

Given the complexity implied by the problems stated, it is necessary to establish a group of non-excluding, related strategies but with a high degree of belonging to those to whom they are applied.

The central strategy is intended to make efforts for the *connection*, oriented to the establishment of permanent contacts with the exports already settled in other countries, in order to identify opportunities that will strengthen the national innovation activities.

As of this contact, it is possible to present the opportunity of applying a strategy for the *return* of Venezuelan talent, through a close monitoring of the internal possibilities and of the conditions of the candidate, in order to incorporate to this process, only those that have a relevance within this alternative. The *preventive* strategy is complementary and is oriented towards the promotion and support of the efforts addressed to create a research and development platform that will provide the answer to the national needs and the attraction to the future researchers that are being permanently formed. These lines of action are based on the need to create a culture of innovation, which will be intended to the new paradigms that are being outlined worldwide.

« En contacto con Venezuela » CONICIT : diseño y asesoria de políticas

Iván de la Vega

Marco de referencia

Venezuela es un país atmpico en América Latina, los inmensos recursos naturales y económicos que ha manejado le ha permitido atraer inmigrantes de diferentes nacionalidades, principalmente en oleadas bien definidas, en la década de los años 50 y en la década de los años 70, las cuales han dejado un legado importante a la sociedad venezolana contemporáneo, desde la transferencia tecnológica hasta en el nivel académico.

La década de los 80 por el contrario, marca un nuevo rumbo para Venezuela ; 1983 el principio de una regresión en todos los ámbitos de la sociedad, que deteriora progresivamente el nivel y la calidad de vida de la población.

El problema presenta una multiplicidad de factores que al combinarse demarcan una situación delicada para el país, las expectativas de crecimiento de la sociedad venezolana en los años 70 y principios de los 80 era inmensa, la economía artificial que genera la subida exponencial de los precios del barril de petróleo (1979) elevando la renta por este concepto, crea una situación de bonanza que nubla el panorama de la mayoría de la población.

El retorno de una masa importante de inmigrantes en los últimos años a sus países de origen, se puede explicar a través de un problema estructural de la sociedad venezolana. La falta de políticas coherentes a largo plazo, además de la corrupción en todos los ordenes han generado el retroceso antes mencionado.

Se mencionan algunos indicadores que permiten explicar el problema :

El fenómeno de la inflación en Venezuela era desconocido, con la consecuente devaluación de la moneda. Este proceso de descomposición de la economía -caracterizada por la dependencia del petróleo- se ha agudizado sistemáticamente, generando altos índices de desempleo y un deterioro progresivo de los servicios públicos. Los indicadores de pobreza han llegado a porcentajes cercanos al 80 % en sus diferentes formas ; el sector informal de la economía ha crecido desmesuradamente ; todo ello ha profundizado los niveles de delincuencia y la deserción estudiantil entre otros.

Circunscribiendo el problema a la dimensión científica y tecnológica venezolana, los enfoques que la habían orientado se basaban fundamentalmente en el fomento y el fortalecimiento de la investigación, como una actividad aislada del contexto socio-económico del país. Con la aparición de los eventos de orden económico y político antes mencionados, se hizo evidente la necesidad de replantear las políticas, a fin de expandir la visión focalizada anterior hacia una perspectiva integradora de las diferentes áreas de acción del hombre, con el propósito de incorporar lo científico y tecnológico en la dinámica global de la sociedad.

Dentro de esta nueva dimensión, una de las consecuencias inmediatas del proceso socio-histórico de la ultima década es la inusual migración de venezolanos al exterior, específicamente conformados por investigadores, con alto nivel de formación que no encontraron espacios de desempeño adecuados dentro de nuestras fronteras.

Es conocido ampliamente que los países desarrollados tienen unas políticas bien definidas de captación de profesionales de alta calificación para incorporarlos a su « stock » intelectual ; es importante señalar las oportunidades que ofrecen universidades y empresas, en un proceso de seducción casi inevitable para cualquier científico y/o tecnólogo.

La emigración del talento venezolano al exterior es un fenómeno relativamente nuevo, comúnmente llamado fuga de talento. En la medida que se ha agudizado la crisis en el país, está ha conducido a un ixodo de los mas calificados.

El análisis se debe centrar en como resolver la situación, diseñando estrategias adecuadas y eficaces que abarquen las diferentes acciones que coloquen al país en situación de ventaja, cualquiera que sea la ubicación del talento venezolano. Lograr la vinculación de científicos y tecnólogos en posiciones importantes en otros países, a través de programas bien orientados en función de trabajar en proyectos concretos para la resolución de problemas de interés nacional, puede convertirse en una situación favorable para Venezuela, mas aun cuando la globalización es una tendencia del nuevo orden mundial.

A continuación se presentan algunos indicadores del panorama global de los científicos y tecnólogos en el país :

Organismos internacionales como la UNESCO señalan que Venezuela debería contar con unos 20.000 investigadores para poder enfrentar el desarrollo con una mejor plataforma intelectual. Las estadísticas indican que existen poco mas de 4.000, lo que es menor al 25 % de los estandares mencionados.

CONICIT reconoce dentro del PPI a 1.050 investigadores calificados de 2.307 inscritos para el año 1994.

UNESCO recomienda mínimo 1 investigador por cada 1.000 habitantes. Francia posee una relación de 4 investigadores por cada 1.000 habitantes, lo cual indica que Venezuela debería tener alrededor de 20.000 investigadores.

Un factor importante es el financiamiento. UNESCO señala que cada país debe invertir como mínimo el 2 % de PIB en investigación. Corea del Sur invierte el 2 %, Francia el 2,3 %, Japón y Alemania 2,8 %, USA el 2,6 %, los países latinoamericanos : Brasil el 0,9 %, México el 0,4 % y Venezuela el 0,4 %.

Otro indicador importante es la generación de relevo que se esta formando y egresando de las universidades e institutos superiores. Sin profundizar en la calidad de dicha formación, las cifras oficiales señalan que en los últimos años existe una tendencia de un 1,6 % de estudiantes que se gradúan en las denominadas ciencias básicas (OPSU), lo que presupone un problema en el relevo generacional. Países como Costa Rica tienen cifras en los últimos años de 2,4 % de estudiantes que egresan de estas carreras.

Informaciones sobre el fenómeno de investigadores que se jubilan o desertan del quehacer científico y tecnológico, señalan que existe un fuerte desequilibrio entre estos y aquellos que ingresan a la investigación. La perspectiva para los próximos años puede agudizarse si no se corrigen las tendencias rápidamente. El promedio actual de jubilación del personal mas calificado en las universidades venezolanas es del 26,5 %. (XLIV Convención Anual de ASOVAC).

Venezuela podría quedar aun mas rezagada de lo que se encuentra dentro del contexto mundial. Es imperativo su inserción dentro del acelerado proceso de la explosión tecnológica. Para ello debe implementar programas dirigidos a la creación de capacidades humanas para la investigación y la innovación en el corto plazo. Sobre todo porque cuenta con un potencial en sus recursos naturales y humanos, más como con una capacidad instalada que debe ser aprovechada, tomando en cuenta el componente tecnológico en el sector productivo.

A continuación se reseñan diferentes iniciativas que se realizan actualmente en Venezuela para identificar cuantos venezolanos calificados se encuentran en el exterior :

La Fundación Polar esta realizando un estudio exploratorio para detectar a estos profesionales y recoger información detallada de su trayectoria en una base de datos. El primer censo o informe, recoge a mas de 250 científicos ubicados en el exterior y específicamente pertenecientes a las ciencias básicas y transferencia tecnológica, que son las aéreas de interés de esa Fundación, para este momento.

Otra iniciativa importante que esta en desarrollo en el país, pero que incorpora a Latinoamérica, es el proyecto conjunto de la Academia de Ciencias de América Latina, la Oficina Regional de Ciencia y Tecnología y la Asociación Latinoamericana de científicos (ACAL- ORCYT-ALAS) ; ellos estan implementando otra base de datos. También cuentan con un periódico electrónico que pretende abarcar a todos los profesionales e incluso a estudiantes en el exterior. Para el mes de marzo del presente año contaban con mas de 400 censados en su lista vía correo electrónico y mas de 200 vía correo ordinario, ya que no cuentan con esta herramienta.

El embajador de Venezuela en la UNESCO, Dr. Kerdel Vegas, es uno de los precursores que pone su empeño en conocer cuantos profesionales se encuentran fuera del país. Parte de su inquietud es como vincularlos con el país y como pueden ayudar a resolver problemas inherentes a su especialidad. Tiene a su cargo otra base de datos, la cual es financiada por la UNESCO y esta enmarcada dentro de un proyecto mundial de migraciones que coordina las Naciones Unidas (ONU) el cual se denomina TOKTEN.

Las cifras mencionadas son todavía incompletas para establecer el panorama de la realidad venezolana, pero se puede señalar que existe una situación que debe ser atendida en sus diferentes vertientes :

- Situación que provocan los continuos egresos o desincorporación de jubilados.
- Escaso volumen de profesionales que ingresan a las actividades de investigación.
- Migración de profesionales hacia el exterior formados para la actividad de investigación en Ciencia y Tecnología.
- Migración de profesionales hacia el sector productivo para ejercer cargos distintos a la investigación, sin dejar en muchos casos el relevo adecuado. Esto en su mismo podría verse como una pérdida, pero también se podría apreciar como una oportunidad, si se realiza adecuadamente.
- El porcentaje de estudiantes becados por el CONICIT, en el período 1990 -1994, que no retornaron es del 8 %.

Esto es una expresión de una problemática estructural que se manifiesta en la falta de tradición hacia estas actividades, en contraste con el atractivo que significa lo mismo en los países desarrollados.

Para finalizar se deben mencionar las diferentes iniciativas que se llevan adelante en otros países de la región como Argentina, México, Chile, Uruguay y principalmente Colombia, en función de vincularse con los profesionales nativos que se encuentran fuera de sus fronteras. Mediante políticas y estrategias bien definidas, en cada uno de ellos existen experiencias exitosas en esta materia, que deben estudiarse con la finalidad de incorporar algunos elementos que se adecuen al programa PEREZ BONALDE.

Objetivos

Objetivo general

Incentivar al talento venezolano residente en el exterior para que contribuya a la identificación y aprovechamiento de las oportunidades de cooperación técnica internacional, que sean de interés para apoyar los procesos de innovación en el país y garantizar los beneficios subsecuentes de esta interacción, a través de la aplicación de diferentes estrategias que potencien la actuación de los investigadores, a partir de las mejores ventajas comparativas que ofrezcan.

Objetivos específicos

- Aprovechar la permanencia de investigadores en el exterior, como puntos de contacto para la movilización de información y otros factores que faciliten actividades asociadas, a través de la incorporación a las capacidades nacionales de mecanismos tecnológicos modernos y actualizados ; mejorando las condiciones comunicacionales y facilitando las relaciones internacionales.
- Crear condiciones nacionales que favorezcan las actividades de investigación y desarrollo tecnológico para evitar su migración.
- Crear la plataforma organizativa que posibilite el retorno definitivo del talento venezolano radicado en el exterior.

Lineamientos de politica

Los lineamientos generales de la política del CONICIT que sirven de marco de actuación en referencia al talento Venezolano en el exterior, son los siguientes :

- Favorecer un esfuerzo de articulación con base en intereses comunes, nacionales e internacionales, en función del desarrollo económico y la calidad de vida de nuestra sociedad.
- Propiciar una cultura de la información científica y tecnológica que facilite la vinculación entre los diversos actores del país con los expertos venezolanos radicados en el resto del mundo, utilizando las múltiples posibilidades que da el desarrollo telematico, a través del correo electrónico con sus diferentes modalidades, (teléfono/fax, multimedia, video-conferencias, entre otras tecnologías),
- Priorizar la vinculación de estudiantes venezolanos (principalmente becarios) que se encuentren realizando estudios en el extranjero.
- Priorizar la vinculación de venezolanos en el exterior que se encuentren en centros que ofrezcan oportunidades de cooperación internacional.
- Favorecer el desarrollo de mecanismos e instrumentos para fortalecer aquellas instituciones que faciliten la incorporación de venezolanos para su retorno definitivo.

Estrategias

Dada la complejidad que implica la problemática planteada, es necesario establecer un cuerpo de estrategias no excluyentes, relacionadas, pero con alto grado de pertinencia a quienes se aplique :

La estrategia central esta dirigida a desplegar esfuerzos para la VINCULACION, orientada al establecimiento de contactos permanentes con los expertos ya erradicados en otros países, con la finalidad de identificar ventanas de oportunidad que potencien las actividades nacionales de innovación.
A partir de este contacto, se puede presentar la oportunidad de aplicar una estrategia de RETORNO del talento venezolano, a través de un fino monitoreo de las posibilidades internas y de las condiciones del candidato, a fin de incorporar en este proceso solo aquellos que tengan pertinencia dentro de esta alternativa.
La estrategia PREVENTIVA es complementaría y se orienta hacia la promoción y apoyo de los esfuerzos dirigidos a crear una plataforma de investigación y desarrollo que de respuesta a las necesidades nacionales y la atracción de los aspirantes a investigadores que se estan formando permanentemente.

Estas líneas de acción estan inscritas en la necesidad de crear una cultura de innovación, que apunte hacia los nuevos paradigmas que se estan perfilando a nivel mundial.

The Dialectics of the Virtual and the Real in the Caldas Network of Colombian Reseachers Abroad

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Introduction

For those States which do not form a part of the group of the “richest countries”, technological management and national scientific competence represent an increasingly crucial issue. Only they, in fact, have the possibility to offer to the country an adaptation to the demands of a market which is increasingly oriented to production with a strong aggregated value. Progress strategies to be inserted into these conditions create the need for technicians, engineers, qualified researchers, who will be capable of innovating and keeping their country in the current of a continued technical progress. Thus, it is made evident that those who do not advance, go backwards.

The statement that “science is universal” and that knowledge has no frontiers, should not be mistaken. The proposal is partly true, but it is also subject to the realities of the relations of forces, which penalize scientific capacities that a destitute State can not support economically. We are, then, attending today an increasing divorce between a worldwide science that every time is more privatized - which does not mean universal - and national sciences that are every time more marginal since they increasingly enroll in a logic of urgency of practical utilizations and of local interest.

The team of sociologists of sciences from Orstom, “Science, technology, development” (Research Unit 54, “Savoirs et Pouvoirs”) has set the goal of analyzing these threatening processes and the possible answers that are or can be contributed, within the concern and, at the same time, scientific research and cooperation with countries of the South. Our research is based on the strength of some work hypothesis (see specially Waast, 1995 ; Gaillard, Krishna and Waast, 1996) :

Science only takes root when the social environment is favorable to it ; it is not enough that there may be scientists and that they have the means available, but it is necessary that these scientists will feel members of a community ; this is measured by belonging to the same profession, by sharing the same system of values that define it and by belonging to one same nation, which means also some of the selections sometimes imposed by the professional practice (selection of a research object, of the partners of the research, of a place of residence, or of the benefit inherent to the country which is stronger than that which is expected in terms of development of the professional career) ;
- for such a national scientific community, to be able to emerge or consolidate itself, its mem-

bers must feel that they remain the masters of their trade, even if they agree to undertake work offered on other fields ; and they should feel that they are not different from their fellow members, other than in terms of the national characteristics of their "style of science" and certainly not be distinguished by a different status ;
- simultaneously, scientific work is not except from the consequences of the phenomenon of globalization of exchanges and privatization of production and services, which emphasizes the desire by the researchers of the South to belong to the world's "invisible college" (Gaillard and Schlemmer, 1996), thus strengthening the homogenization of science to the detriment of the specificity of a research excessively localized to be taken into consideration in the single "global" market ;
- on the other part, a national scientific community is not limited to the members who reside in the national territory : those who have emigrated may, also, contribute to strengthen the scientific capabilities of their country ; and the "useful" science for a given country is not limited either to the science produced within its frontiers.

We do not have the arrogance to believe that we are the only ones or the first ones to have issued this hypothesis. To the contrary, as nobody ignores it, an increasingly important number of countries has been forced to retake the problem of "exodus of competences" or "brain drain" considering, to the extent that these same researchers could contribute to the country greater competences, that the fact that they have received their education and are working abroad could become a "gain" and cease to be seen as a "drain"- whenever it does not represent treason. The idea is to create a national scientific community, sure of itself and reassuring, but which, at the same time, will not be excluded from the scientific school of peers, from the competence and from international competition [1].

And this subject -decisive for the struggle by the States of the South to keep in the current of an international science - which we have wanted to study, referring to the "ideal-typical" case of Colombia, with its "Caldas network", of expatriate researchers, which was put into operation four years ago [2].

The Caldas network represents, undoubtedly, the most conscious and elaborate attempt of what we call "the diaspora option" (see specially Gaillard and Meyer, 1996), and its success would represent without any doubt a path to follow in order to create or recreate such scientific capacity, notwithstanding, or rather, thanks to the great geographic dispersion of its researchers. This network brings together the members of the Colombian intellectual expatriates, mainly among them, in the different places where they live, as well as in the own country and with their peers, within the country. The Caldas network attempts to be, therefore, an extension of the national scientific community outside its frontiers, and an anchor of same in the internationalized world's science. For a small developing country it is a considerable mobility and a significant demultiplication of its research potential. This idea has not been imposed by itself : the Caldas network was born from the combination of a tool -Internet-, of expatriate researchers who knew how to use it among themselves, and not necessarily with scientific purposes, of a national political-administrative body in charge of research -COLCIENCIAS, which wished above all, at its beginning, the return of its researchers- and of a man, Clemente Forero, who was then director of COLCIENCIAS who knew how theorize and impose the master idea of the Caldas network : without a need to make the scientists return to the country but, to the contrary, benefiting from their entering the best laboratories, simply connecting among themselves the national researchers who were finally better located- because from the heart of the system -science- it is possible to invert the direction of the exchanges, the country of the South may be benefited, finally, without the country of the North even realizing it. This is a connection between the flow of men and the flow of ideas, and the departure of the former may be the best means to import the latter.

However, although it is true that the model seems convincing, putting it into operation entails, as it is always the case in human enterprises, its part of contradictions. "Universal science"

does not have a reality if it does not implants its roots in a concrete, local reality, and in its combination with a specific human instruction (as well as, inversely, the ideas of this or that human instruction become sclerotic if they do not have exchanges and if they are not elevated to a universal level). Therefore, it was important to see how this idea of creating a virtual national scientific community was lived in the local "nodes" of this worldwide web of Colombian scientists.

Problems of method

Our study on the Caldas network was initiated practically at the same time that the Caldas network began. Therefore, we have studied a process that was being born. This fact involves a certain importance :

- it means, first, that we can not present here an "ontological reality" of the nodes but a simple snap shot taken at a given time of its evolution - an evolution still very fast and fluctuating. What we say about the Belgian node, for example, has no other validity than this : at a given moment, when we went to study it, this node presented a certain configuration. It is possible that at the present time it may have fully transformed. What we describe existed and that is all we can say to this respect ;
- but an organization which is being born implies also a great fragility with respect to the exterior context ; its advocates, its directors, for example, reacted to our research and this reaction always seemed to us, for the observers that we were and for whom the "pleasing neutrality" was the standard of conduct, somewhat out of proportion : whether they distrusted us, kept us at a certain distance, or to the contrary, that they expected the truth from us, the support to their wishes the sharing of the same enemies.

We knew the two attitudes, the first one less frequent and always followed by the second, but we were rarely seen as uninvolved observers. Let's clarify, however, that if, in good scientific epistemology, we should have been so, we were not ! We were not really neutral to our study object and have no difficulty in recognizing that we wished the success of Caldas, that we could not hide our admiration in view of the ambition of the project and the work already performed, that we had the conviction of having there, as a study object, an initiative that could very well become a model, which was exposed to being at the origin of real transformations of the relations of strength that joins non hegemonic States and worldwide science.

The problem of the "researcher's neutrality" arose here, but we know well that, in social sciences more than in any other field, the observer is never neutral and his first duty is to be conscious (to this respect, our task became easier). And if our look was a little more than "accommodating", we were far from the problems of the research-action. We were not there to take part, we did not have any action plan or policy objectives to reach, we did not have a preconceived idea on the process that "had to be developed", its rhythm, its development, its orientation. We would discover a reality that was being constructed under our view, we were observing it as it was being born, instead of wanting to transform it into another previously given, known reality (but effectively full of hope as refers to the course that it is going to take...).

Then, the question is not the right that we could have had or not to orient the process in course, which poses a problem, but the scope of the conclusions that could be drawn. The first question is resolved with the evidence : in the name of what value, of what moral would we question the right to feel solidary with an initiative that was directed towards a more equalitarian

world, of greater management, on the part of disfavored countries in the competition in progress of their scientific possibilities ? But the second one indicates the risk involved by generalizing conclusions on the success of a process, disguising the fact that it has been performed, partly, thanks to an external support that would have oriented its dynamics. Let us take an example : this contribution refers specially to the discrepancy that existed between the model of network dominant in the discourse of Caldas and the model actually put into operation in the different nodes. In the official model, the putting into operation of the Caldas network electronic forum permits to the Colombian participant to enter the world of science converted into a village : the distance is abolished and each one can dialogue with his neighbor, individually. In reality, the world is perhaps a village, but it is necessary to admit that few people are found in the great place and that the dialogue is limited to the family home where the windows are, no doubt, partially open, but the door is closed ! This evidence lead us to systematically ask, in the interviews that we had with the members of the nodes that we studied, about the problem of the connections that are or not established with scientists, whether or not Colombian, in Colombia, in their countries of residence, in other places, no matter where. Then it is well evident -and this was told to us many times, spontaneously- that we were opening (or reminding them) new horizons, opportunities about which they had not yet thought (or not very frequently), and that, we contributed to some extent to break the barriers of this village-world.

But we do not boast about our influence, minimal, no doubt ! It is necessary to emphasize the following : the process of construction of the Caldas network and its nodes was simultaneously developed, oriented and reoriented and which was constructed over this, our discourse, that could orient the course, comfort it and ruin it. This was worth determining as a starting point.

Two additional clarifications :

- we have guaranteed anonymity and we respect it. When the interviewed person is one of the official advocates of the network and when the purposes informed seemed to us to have a tie with his responsibility, he could be quoted, either that we had planned to prevent it in advance or that we had submitted, for verification, the text of the interview ;
- we prepared the remarks from what we have been able to observe : Austria, Belgium, United States, France, Great Britain, Mexico, Sweden and Switzerland. Some had a greater follow up than others and, specially, the survey was not all inclusive. For example, the fact that we never mention the Spanish node does not mean at all that it does not exist or that it is not significant.

Great variety of nodes

Every local node has its own characteristics, due to the history of its constitution, to the population of the group of scientific expatriates, etc. This is sometimes extremely volatile (it is the case of the nodes of countries where the Colombian population interested in science is essentially made up by young doctors who are renewed too fast in order that a crystallization around some strong figures may occur), and thus the same node may present, with a few months'interval, a radically different configuration. In addition, an internal "crisis" may also transform a node in a considerable manner, simply because the direction team changes.

Among those we have observed in particular, it is possible to establish a kind of typology according to their "degree of opening" and according to two axis of which one -the external opening- seems to be contingent, but the other -the internal opening- refers to a more fundamental opposition, to the style of science that it is intended to put into operation [3].

Opening with respect to foreign countries or internal consolidation

The first axis, in effect, opposes what we will call the “exocentered” and “self-centered”. In the extremes of this axis, we can mention the British node, on the one part and the Belgium node on the other. The two are innovating, creative and mix, apparently without any tensions, hard sciences and human sciences, activities of a general interest and specialized scientific activities.

But one, the Belgian node, is very active in its attempt to organize the Caldas network at a European level, very careful to break barriers. It offers to whomever wants to take advantage, it competence to participate before the European Community and would wish a change to expand its horizon which the reception by its country makes it appear somewhat closed : Belgium is at the same time a small country where Colombians have difficulties to find a “critical mass” of researchers in which they can feel immersed and the country that is the seat of the European Union, which arcana allow, to those who know how decipher them, to access the entrance to an international dimension. The coordinator dedicates, therefore, an important part of his time to convince his European peers, that the constitution - at least of external use- of the regional confederation of Caldas nodes would only have advantages : some times, he explains, each node performs the same work (dissemination of information, for instance) and a European liaison “Bulletin” which would represent a considerable savings of time ; in order to cooperate with foreign countries it is better to make a joint introduction, that is, to have some weight ; there are also invitations to participate that require, in order to enroll, the coordination of laboratories from several countries and therefore, a better position would be attained. The meeting that was held on this subject had an enormous success and it seems to have convinced, in particular, the coordinators of the French, Italian and Swiss nodes, but not everybody.

In effect, an inverse attitude prevails in Great Britain, where succeeding coordinators seem, above all, very careful to structure more strongly their own node and they do not think about what is going on in the continent. The British node appears hardly desirous of corresponding with foreign countries : the ties have been created with Colombia, naturally, the same as with the researchers from the United Kingdom, but the opening is not evident -not the least- with scientists from neighboring countries, even if they are Colombian ; for example, with the Belgium node, so close, but very demanding ; or with the French node, country in which the person in charge of the Great Britain node confesses to have lived recently without looking for or finding his Colombian colleagues ; or even with the Swiss node which does not have the feeling that its visit to the Colombians in Great Britain may have mobilized a great world, that its passage had seemed to them to represent an opportunity for the development of scientific cooperation with expatriate Colombians. We do not have here, as for Belgium an immediate explanation : could it be that it is necessary to incriminate the British influence and their tradition of “splendid isolation” ?

Opening or closing of hard sciences

The second axis opposes the nodes of the hard sciences that are represented, and the nodes in which non-scientists participate ; in certain nodes the researchers of hard sciences have “taken charge”, which they do not intend -unconsciously at least - to share with the human sciences considered as non-scientific, even less so with those who adopt a cultural and social militarism, which would be contrary to the own essence of the Caldas project ; in others, on the other hand, the scientific activities are not even dominant.

The Swiss node, for example, is one of the most dynamic nodes to put into operation international scientific projects that bring together Colombian researchers who work in Swiss laboratories, Colombian researchers who live in the country, and foreign researchers, whether Swiss

or not ; but it is well centered in the “hard” sciences : human sciences do not find their place and even less so those for whom scientific research represents a center of interest but who are not professionals in research. Even the researchers of hard sciences, but who are not involved in a specific research project connected to Colombia, feel more or less excluded. The network of active researchers although very stable is a heavy tendency : it exists since the origin of the node, has become concrete very quickly due to the disaffection or by the retirement of an important number of members who, on the other hand, it was not planned to retain - not even prevent, when a general meeting was held, since the preparation of the project took over the spirit of the active members. This situation was revealed to us by the latter who, in September, 1994, had become perfectly aware, were judging accurately this practice as a dangerous road, and were getting ready -they held visibly with all sincerity - to define the means for a greater opening. A little over one year ago we had found the same situation. Under the same perspective some nodes evidence a concentration in a specific field, such as medical sciences in the Swedish node, in Stockholm, where most of the members are professionally enrolled in the prestigious Karolinska Institute [4].

Contrarily, the New York node - the person of charge of which was for a long time and until recently a lady musician, director of orchestra - has an overwhelming proportion of Colombians who are not researchers but artists, litterateurs, members of the liberal professions, etc. In fact, the number of actually active researchers represents less than 10 % of the total members. It is not surprising to know that this node does not perform only scientific exchanges but all kinds of social and cultural activities (mutual assistance, etc.). This node has just changed directors, a scientist who has succeeded the artist. This is going to modify its activities and up to what extent ? The great harmonious concurrence of this node - the most active of those established in the United States, but perhaps not in the scientific field - makes it that its evolution would be so much more interesting to observe, but it is too soon to guess the direction.

The French node appears to be the most balanced one, but perhaps because it is one of those we know better. And again, currently, at this time in its history that we can say so. If our description would be related at the time in which we have started our survey, we would in fact notice its important representation of researchers in social sciences, but we would add that this has been made at the cost of evident tensions with researchers of exact sciences : the latter had the impression that the node lost its soul, its specificity and - from the point of view of the relapses expected personally- its interest, to a point that some retired from the association. Asked before, had we maybe talked to the contrary of a domain by hard sciences ? A change of direction modified deeply the panorama and, three years later and thanks to the constant renewal of its members, thanks to the arrival and departure of those who completed their doctorate studies, there is no trace of an opposition hard sciences-social sciences, but in the memory of the old member. No node has taken “roots” in the typology outlined above.

Particular historic conjunctions

The characteristics that distinguish each one of the nodes of the Caldas are the result of the circumstances of a double history, and of its articulation : the “official” history of the network, on the one part, and the history of the Colombian expatriates on the other.

The Caldas network, a national and voluntarist policy

There is a prehistory in the Caldas network. In 1970, simultaneously with the birth of the ACAC (Colombian Association for the Advance of Sciences), COLCIENCIAS (the Colombian Institute for Scientific and Technological Research) and the ICFES (the Colombian Institute for

Higher Education), the two created in 1968 (together with the CONCYT, National Council for Science and Technology), a group of experts in scientific documentation were met, also under the protection from the OAS. They concluded about the need to "take into account the concept of information and documentation network that connects libraries and information and documentation centers in order to allow : joint access and documentation of disperse assets, the national and economic use of technology through automated communication systems, the more rational use of available resources in professionals and specialists in information, a greater facility of technological transfer and the assimilation of new concepts of systems engineering and cooperative programs" (Hurtado-Galvan, 1993, p. 205). It is possible to read this text thinking about "laboratories" instead of "libraries", "scientific results" for "information" and "assets" ; finally, "expatriate researchers" would replace "available resources". It is observed that everything, or almost everything is there : the recovery of a disperse collective knowledge, through the technologies of the computer information network, in order to perform scientific development projects in cooperation.

But there still would be necessary to realize and accept the opening of the country to foreign countries. The opening of the country could date back to the end of the '80s, but it was the great merit of a man, Clemente Forero, Director of COLCIENCIAS, who understood that the important thing was not so much to guarantee the return to Colombia by expatriate researchers (nor to pursue the analogy, that the important thing today was to have physically available all the books in the library), but to obtain that they would act from abroad towards Colombia, that they would benefit the country from their insertion into the laboratories where they worked, of the networks of scientific relations that they had established. Maybe he was not yet thinking then - that was what we were informed by those who accompanied him since the beginning of this adventure- about a network specially of computer information, the nodes of which had only been established by two or three people at each central point, to direct and disclose again the information. A "world tour" was organized in 1992, during which Clemente Forero presented his idea to the Colombians that it was possible to gather, frequently with the concurrence by the embassy, supporting on preexisting Colombian associations, or by the bias and the chance of personal relationships. The unquestionable charisma of COLCIENCIAS'director did the rest : the nodes of the Caldas network were born one after the other, as his journey was continued.

COLCIENCIAS was not satisfied with giving the initial impulse, but continued with its voluntarist policy for the development of Caldas : in effect, COLCIENCIAS financed, for some time (six months renewed once, in general), the launching of the nodes, requested the embassies and consulates to contribute to this initiative (specially by accepting them), which strongly suggested the students candidates to an opening abroad to enroll locally in the Caldas node, to request all the Colombian researchers who were in a mission in a country where there was not yet a node to talk about Caldas and to mobilize the local scientific community, etc. (This can not lead us to believe that Caldas may be one of the administrative services of COLCIENCIAS ! It is to the contrary a project extremely decentralized, bland, autonomous, with minimal vertical structuring. But it is true that there is a certain ambiguity and we will discuss this later on).

Answer to a waiting

It was not sufficient that Colombia would open itself to foreign countries and to Colombians abroad ; it was also important that Colombians abroad would open to the idea of working with the government of Colombia and working as scientists with Colombia. "The constitution of the Caldas network of researchers abroad (...) can not be conceived but taking into account the various factors that concur at a given historical moment. The first of them is the willingness by the sectors of the group of Colombian expatriates (...) to work from their place of residence in

favor of the development of the country" (Granes, Meyer, Carrillo and Murcia, 1995, p. 1). The wish was latent and only sought to express itself. The political opportunity in Colombia had been noticeably modified, and the wish to participate in this process was increasing, of feeling "entirely" Colombian. In February 1990, a young physicist living in the CERN (International center for research on particle energy, in the French-Swiss border), Fernando Rivera, launches through the electronic messages a call expressing his wish to contact other Colombians and receives at least 15 answers in one day. This is the birth of the list-serv, institutionalized in 1991, under the name of COLEXT (Colombians abroad), which soon will gather about five hundred subscribers. It is through COLEXT that COLCIENCIAS is going to disclose its "Letter" of information, will launch a debate on the new scientific policy, will prepare the trip by Clemente Forero, and it is from COLEXT that the Caldas network will be born in January, 1993.

Local characteristics

That is the scheme in its entirety, the conjunction of factors that permitted the birth and development of this company. Locally, this supports itself, in addition, on diverse configurations.

- In the federal state of Germany, for example, research is closely linked to the universities that contain laboratories and even more so to the "Professor" from which it depends ; here a classical German node has not been established, but rather a kind of federation of micronodes, each one connected to its own university.

- In Austria, a group of Colombians resident in Vienna had been constituted since 1989, under the name of Cultural House, with its journal "La Chiva" and its work groups, among which a group of "computer science" and a group of "information" were particularly interested in computer science ; it can just be said that a "node" was created ; it is only this group that when discovering the existence of Caldas, decided to orient and develop more its activities in the direction of the scientific environment.

- In New York there was no waiting either for the creation of Caldas to create PECX (Colombian professionals and students abroad), the association that constituted the node ; it was born from a debate that occupied many messages in COLEXT, on the subject of expatriation of researchers : were they to be considered as "traitors to the country" ? (in summary, we are caricaturing naturally, but the subject referred to it). A group of researchers and students, a little more than twenty, met to debate, in November 1991, and the idea of the association imposed quickly : all of them put on top of the table a $10 bill as dues and the PECX was born.

- In other places such as Houston (United States), it is to the odds of the changes of residence that the constitution of a new node is due : it so happens that the two founding members of the PECX (the New York node) came to live here in 1993.

- In other places (Paris, London, Washington) the constitution of a node could be supported on Colombian researchers who already knew each other as militants of the same Colombian scientific association, but who had developed a specific node ; in other countries (Belgium, Italy, Switzerland), only cultural or social association, or directly political ones, were offered to expatriate Colombian researchers who did not have any experience about what an association with scientific purposes could be.

- In all places visited by Clemente Forero, great enthusiasm had been developed at least at first, and energies had been mobilized, even among those most reticent to cooperate with an institutional Colombian instance ("yes, but he is a scientist, and not a bureaucrat, he understands the practice and the logic of research", one of them explained to us) ; but there are places through which Clemente Forero did not go by.

- Another factor : in some countries (Belgium, Mexico), the embassy knew how give a particularly active, imaginative and efficient support ; in other places, undoubtedly less motivated or perhaps with less free time, the embassy was satisfied just by making some premises available to the node.

However, although it is true that each one of these factors could have some weight in the specific configuration of each node, it is necessary to verify that they are not of form, evident or univocal. In certain cases, as in Great Britain, for example, the occurrence of previously favorable factors (preexistence of a scientific association, visit by Clemente Forero, support from the embassy) did not prevent the node from being slowly institutionalized : the first meeting, organized in the consulate with the presence by Clemente Forero, was held in April, 1992 ; the first General Meeting, with gathered more than 80 people, in January, 1993, and the first election of the executive committee, in February, 1995 ! In other cases it was the other way around, such as specially in Sweden, where there was not a scientific association capable of grouping Colombian researchers, and the fact that Clemente Forero had not come personally, not counting the relative weakness of the members, did not prevent the node from existing rapidly and to operate in a correct manner.

In general, the enthusiasm in the first meeting becomes evident in all (the coordinator of the Swiss node confessed to me with some humor that he practically discovered at that time that he was not the only Colombian in Switzerland !) ; but in Switzerland, all the researchers in human sciences rapidly disappeared ; but in Mexico, at the beginning in each new meeting the number of participants melted like an ice cream in the sun (before the appointment of a coordinator would give this node the minimum stability indispensable with a regular attendance by 8 to 10 participants) ; but in California, the person in charge of recording the by-laws of the association, the creation of which had been decided, suddenly disappears without leaving any traces ! It is only upon the creation of the ACASTC (association of researchers for the advance of sciences and techniques in Colombia) the French node, undoubtedly one of the more dynamic and strongest, the initiation of which was quickly marked by a period of discouragement, skepticism, deception regarding the very idealized speeches by Clemente Forero, while nothing concrete seemed to result, which shows well to what extent it would be absurd to classify a node as intended to operate well or to decline. But this shows also that the problem is to understand what has been achieved by the mobilization of Colombians abroad around the development of science and how to maintain this militancy.

Questions on mobilization...

Since the proposed identification model rests at the same time on the postulate of a universal science -it is necessary to leave Colombian researchers in the laboratories of the north- and on the patriotism of its researchers : they must feel Colombia, mobilize, militate, in order that the network will operate. It could be assumed then that most of the expatriate Colombian researchers had sought to justify to themselves their departure by joining exclusively the professional group of reception, amalgamating as much as possible their belonging to a country somewhat scientifically margined (with respect to the large geographic centers where current science is made, as well as in relation to the subjects and the styles of science imposed by this mainstream) ; the Colombian scientific society preexisted at the beginning but, considering the number of its members, it is a disperse community without roots, which could have survived ; or, the interesting paradox is the other way around, and is that parting from the group of expatriate scientists, for a certain number of Colombians “from abroad”, it seems to have awakened this strong feeling of community belonging to a national professional group.

From the time the project was launched, one of its promoters explained this way to one of us [5] that, among the reasons that explained the mobilization and enthusiasm of Colombians for Caldas, there was, on the one part, the extent of the historic rupture which represented the current globalization in Colombia ("it is only defined as being `against´ or being `for´ ; thus the extent of the adhesion movement") ; on the other hand, the possibility that was offered to them for being actors, creators of networks, and not simple elements of a preexisting network, of "generating gears and not being simple pinions". Prior to Caldas the researchers committed to cultural or social associations, of defense of human rights, that is, purely scientific ; but a good number of them did not integrate entirely and these associations consumed a lot of energy, not always showing concrete results. "Science gives them a neutral territory, beyond the militant divergence", continues the same person in charge already quoted. We found a "we, Colombians", as gratifying because it is immediately legible abroad and positively legible ; an identification in actions that work is found.

Under the same perspective, the coordinator of the French node explains to this need to join the "Colombianity" the success of the ACAST with respect to the other associations that preexisted in France. ALAS for example (Latin American Association of Scientists), groups the researchers of Argentina, Brazil, Chile, etc.. Because of its objectives and methods, it is the closest association to Caldas : without upsetting anyone, it can be said that it does not show the same dynamism. However, it has its advantages : its headquarters are in UNESCO, has developed excellent networks of relations with scientists of South America. But the feeling of identity, mobilizing, is very diluted, in a regional belonging and not national ; in addition, this association, created in 1981, is made up by researchers mostly well inserted, professionally, and who develop a less militant patriotism.

It is necessary to distinguish, however, that which is dominant in Colombians abroad, who are in the Caldas network : the feeling of belonging to the national community, organizing themselves at a scientific level, or the feeling of belonging to a scientific community organizing themselves at a national level ? Well the more Colombian they feel, the more moved they will be by the idea of helping the country, no doubt, but the more they will yield to the temptation of transforming the network in an association of exchange and mutual aid, thus diluting their strictly scientific potential -and losing their colleagues who refuse to lose sight of the fact that it is a scientific network. To the contrary, the more scientific they consider themselves, the more they will wish to make of the Caldas network an international scientific network, which favors the exchange with their peers, without being too concerned about the exodus of their colleagues somewhat outside their field, since they do not see very well why to intermingle with them under the pretext that they are Colombians : Science has no frontiers.

The answer during these interviews that we were able to carry out is very clear : it is the first case of a widely dominant figure, even if the other one is also represented.

For the latter - "scientists above all"- Caldas must develop first of all around concrete scientific projects. On the other hand, if there are possible exodus of investments in fields really considerable, which are approved while being active members of Caldas, it is useless to expect now to maintain a mobilization, they explain. On the other hand, the creation of projects, is at the same time the best means to help Colombia and the only means to do it staying without changing the place of residence, since this develops exchanges with other scientists and therefore, improves the knowledge by Colombian scientists ; finally, it is the only means to maintain ties with the country, both scientific and sentimental (to find again the "smell of guava" referred to by Garcia Marquez, to keep ties with culture, the language, the community feeling).

For the others, the most numerous, it seems that to the contrary, there is a need to reestablish, or create, these ties with Colombia which represent the most gratifying aspect, those which permit, here also, to allow a considerable consumption of energy in order to enliven the node. And if the "scientists above all" talk specially about projects in which they commit to Colombia,

and exchanges that they perform for their own purposes in the electronic network (Caldas network). For the “Colombians above all” it is the node which predominates, local rooting, where the Colombianity is physically seen, in all spontaneous discussions and not only in the programmed scientific aspect. “On the Caldas network, it is required to be scientifically very strong in order to say that something is contributed to Colombia ; in the node, it is different. If this would relate only to science, it would be sufficient to be a good researcher and connect to the network ; in the node, additionally, you militate, you work for the love to Colombia”. It is not surprising to find in this case researchers in social sciences, in addition to the most committed researchers in the Colombian sociopolitical life : “to talk about social sciences, in the Latin American context, is necessarily to advance in democracy, because it is to talk about society, of social problems, policies”.

The priority given to the commitment with Colombia, where the scientific character is secondary, has been confirmed by what we have been able to know about Colombian researchers who do not mobilize through Colombia, neither as scientists in Caldas, or as Colombian in any other sociocultural association : the reason invoked is usually the need to devote to study, the refusal to dedicate any time to other occupations -the work is present as an indispensable investment ; rarely, very rarely, the feeling that devoting the time to the country is a somewhat useless loss of time, is evoked.

During the course of the international conference “Twentieth Century Sciences Beyond the Metropolis”, in the workshop devoted to scientific migrations, there was an exchange between Virginia Cano, who was asking herself about the impact that could have on the Colombian scientific community the fact that Spain tries to repatriate Colombian researchers who are former exiles - or descendants from former exiles- of the civil war, and Clemente Forero, who answered to them that this would not have strictly any impact, since they would always be connected to the Caldas network and that the place where the researchers were located had little importance as long as they were interconnected. If I am allowed to participate with some delay in this debate, I would say that at the light of what we have just seen about the militancy of Colombian researchers, that the answer by Clemente is insufficient : these Colombian-Spaniards will not continue, in fact, communicating in the Caldas network if they do not always consider themselves members of the invisible college of Colombian researchers and unless they continue feeling Colombian. It has little importance, in effect, that they may be in Spain, or in any other place, except if they discover in any way that they feel Spaniards !

... and of demobilization

We understand the deep reasons for the enthusiasm that has aroused the launching of the Caldas network. Almost all interviews with Colombians who lived in this period talk about their very strong mobilization, of the passionate climate existing then, of the impression, with just reason, that became a valuable collective identity, and which improved the image of the country.

For an expatriate Colombian scientist, the confession of its nationality was for him a burden, since it remitted people very easily to the stereotype “Colombia = drug”. But since then, proud to explain what Caldas was and even prouder of not having the need to explain it he invoked the existence of the network that threatened with extending, as an original and passionate initiative.

But in order that a human organization may have continuity, it is required that after the momentary enthusiasm the conviction of long lasting will follow. And to achieve this, it is necessary to embrace the feeling that the efforts agreed will lead to actual and gratifying results for itself

(that these results and their gratification be materially symbolic). “The program for repatriation of scientists and the programs of COLCIENCIAS in the development of training periods, of scholarships to study abroad and finally the common work projects are the expression of the compatibility of interests”, wrote very fairly J.B. Meyer and J. Charum (1995, p. 1012) to describe the Caldas model. But in order that these interests will be compatible, they are exposed to the risk, as any other interest, of being disappointing and, between the model and the reality, there may be a margin where the demobilization can take place. And even more so to the extent that the expectations are greater : it is for this reason that the phenomenon was more or less generalized, even though it was possible to reabsorb it later.

Colombians were willing to admit that just the members of Caldas must do something for Colombia and not that COLCIENCIAS must do something for the members of Caldas. However, they continued expecting that, once they did their part, that is, forming the local node and after dedicating much of their time to make it operational, of having established contacts, making the network denser, they could take advantage of the work performed to receive something in exchange, although it were only to receive information. They considered that the network should help them concretely, for example, to receive information about the steps to be followed by the candidates to a scholarship, to facilitate the obtaining of the card for staying, housing, trainee’s work, financing, information on scientific literature, assistance for their own publications. And here it is necessary to recognize the lack of this retribution.

All the nodes have not suffered to the same extent this lack of affection. In Switzerland, specially, most of the researchers have a stable position and even under a scholarship are benefited from an assistance from the Swiss government, but not from COLCIENCIAS. Neither during their stay or for their return, they feel pressed and their expectations are not so strong. Projects are established rapidly which would mobilize those who were interested. On the other hand, all the rest ceased very quickly to be interested in the meetings where nothing was said that would involve them. Such reflux was sometimes brutal. In France, the first meetings gathered around 300 people : very quickly this figure fell to less than one hundred : “why wear out, what means do we have in order that this will work, what interest in continuing if it is a one way only project ?” In Mexico it was decided, in the creative phase of the beginning, to distribute a questionnaire in order to know the status of the Colombian scientific forces in the country : 21 answers were received which were lost ! It is true that the meetings were not held to discuss specific objectives and that, finally, the participants that were not committed to research and came just by patriotism became tired, and those that came as professionals did not see that the network would contribute anything to them, or to science -specially to themselves : the hope that the network could serve to facilitate the return to the country, find work, etc., crumbled down very fast as a naive dream.

The Mexican node was capable of reestablishing the situation, but only to a certain extent : from that moment on a regular, quarterly meeting is scheduled in the embassy, which gathers with a certain persistence about ten people, with a concrete agenda but, as in Switzerland, the participants are those who have exact projects to perform. Switzerland was not able either to find those who had been mobilized at the beginning (there is no bulletin, there are no meetings with a fixed date, there is no systematic summons). But there where the number of Colombian researchers is sufficiently important to be less sensitive to this type of effect, things have taken a course more in accordance with the initial idea of the constitution of the nodes and, in a credible waiting and after a credible waiting and of the radical deception, a less excessive perception of reality was developed. So much so that although it is true that for the majority to be a member of the Caldas network not always contributes something, except in a marginal manner, the access to the scientific network contributes to the access to a strategic network that really facilitates the research of resources of employment, of a stronger employment in Colombia for the day of the return. The reflux was no doubt, a temporary circumstance, but it poses the problem of the relations between Caldas and COLCIENCIAS.

COLCIENCIAS, seen from the nodes

“COLCIENCIAS represents a considerable advance, revolutionary with respect to what existed before. There is the head that takes initiatives, moves, understand what research of science and scientific practices is, but underneath this it is the disgusting Colombian bureaucracy”. This analysis by one of the founders and one of the chief responsible for the Caldas network is found -specially, we must say, its negative part- in a great number of the interviews that we performed. This analysis extends in addition to Colombian universities, incapable of joining and understanding each other, of joining forces, since each one of them wants to dominate the other : “With the Caldas network, it is easier to find cooperation in New York, London, Paris and Geneva than in Bogota and Cali !” It is criticized specially its silence, its heaviness, its slowness, in summary : a deficient communication ; it is censured its lack of financial support, of assistance, of the means assigned, in brief : a bureaucratic accounting management ; it is reproached in addition, the lack of clarity on the role of the nodes and the coordinators, the absence of an international perspective of research (“they send us all the documents in Spanish, therefore I had been forced to have them translated into English if I want my peers to know them”), their lack of understanding of scientific logic (“my project was rejected, claiming that it had already been performed, as if everything done in the same field, with totally different methods and problems were equivalent !”), in short : an unfavorable administrative view ; it is finally criticized for considering Colombians abroad just as the pieces of a chess board of Internet which can be used, for favoring widely the projects on hard sciences, for not refining their selection criteria in order to be free to make decisions ; in summary : although it is not visualized as a political manipulation of science, it is viewed indeed as a political management. When it is known with what means and what human resources were working those who, in COLCIENCIAS, were in charge of making the Caldas network operational, it is possible that these criticisms may be unfair. But to keep a misunderstanding silent does not help to dissipate it. Naturally, it must have been already understood by now, that it is specially during the course of the period of launching and consolidation of the network that these accusations flourished : COLCIENCIAS, overflowed by the success of Caldas, let the gap between the hope planted by its director and the concrete falls increase, without establishing a clear policy which would permit to know what could be really expected. Although it is true that the differences have not been forgotten, today the judgment is not so negative. It is acknowledged, however, that its moral and financial support has been a determinant fact. And then, that it was thanks to COLCIENCIAS’initiative that Caldas exists and this initiative which was extraordinarily well appreciated, benefited enormously the image of Colombian science and of Colombia. But it is a two-edged matter, they explained to us because at the same time it made evident its lack of expeditiousness and its failures (the problems of the scholarships that do not arrive, for instance, occupied in the network at a given time, an outstanding place) : “it is also a wonderful means for pressure, for democracy !”

And there is not a unanimous position regarding the solutions to be given to the problem, and the evidence of it is that these solutions are not imposed in an apparent manner. Either a reinforcement is expected for COLCIENCIAS (“if only COLCIENCIAS had more power, with a true ministry, with a true budget, a real capacity for decision making... !”) ; or an open separation between Caldas and COLCIENCIAS which would clarify the situation and would prevent false expectations. Let us note the two propositions which are not incompatible to each other, and which anyway, that which is required is a reinforcement of communications with Colombia : “This should be the most important node for Caldas, but by far is the less efficient. It lacks any links by people who exercise pressure in Colombia, to establish the relevant ties”.

Two conceptions of science and scientific

The explanations of the relative discouragement that has affected most of the nodes, and of the mobilization that followed it, of the distrust towards COLCIENCIAS and of the more benign judgment that followed it, reveal again, in our opinion, two different fields, between which, one, for our proposal of typology of the nodes, is a more according to the occasion and the other is more structural. For our typology, being occasional refers to the space : you resided or not in a country with a restricted scientific community ; here it refers to time : this is still a phase where the expected exceeds by far the concrete relapses. But in the two cases, the structural opposition derives from the view one has of science and of the role of researchers, and of their relation with civil society ; there is more deception to the extent that one is more “science above all”.

We have seen throughout this text this opposition between “hard science” and “human sciences”, an opposition that is nothing but the most frequent and most evident expression of this other rupture : that which separates an “internalist” view of science and a more sensitive view to its social contextualization. The problem lies in knowing whether science is not developed by itself, from itself and, essentially, for itself ? If society and science are connected and the one offers the other the means for its operation : under the form of financing for one, under the form of results, technical progress for the other ? Or the research problems that derive from the mere scientific questioning have to do with the problems being faced by society, without a possible scientific answer ? In summary, is the history of sciences that of a specific discipline, or a particular branch of history ?

To this question the nodes answer implicitly, when they are asked who could form a part of Caldas. And most of them had asked it explicitly, starting by COLCIENCIAS, for which, at the beginning, the network had to be rigorously scientific and exclude even students. It was to eliminate candidates not recognized as researchers that it was necessary to answer the curriculum vitae that COLCIENCIAS requested all those who wanted to enroll in the Caldas network. The Italian, Swedish, nodes at least at their beginning, adopted the same positions. And although it is true that the Swiss node and then the Swedish node in a second term accepted students, they wanted to limit the participation to those who at least had a relationship with science (even though it were a social science). Notwithstanding the opinions by some who were inflexible (“there are students who enter the association with the hope of obtaining something, but the purpose of the association is not to obtain something ; the students should first complete their thesis and then enter the association”), thereafter, however, no student has been rejected from Caldas.

Regarding the problem of the limits that must be established to the group, others only responded -at least up to what we know- in a implied manner, or responded with the facts in a different manner from their response in the discourse, but sometimes closing even more the “group of belonging”. Although no place social sciences have been presented officially as “not sufficiently scientific” in order to make a part of the Belgian node, at the beginning, or the Swiss node, always, these sciences have been margined (and we have already seen that there was a suspicion that COLCIENCIAS was doing the same). In Belgium, at a second opportunity, in Italy, in Great Britain, in Sweden, in the California node, social sciences are present and only in the French, Mexican and Washington nodes non-scientists have been excluded (only “interested” in the development of science in Colombia). Finally, only in New York, the opening is full, anyone can participate from the moment he wishes so (up to a point that, according to what was held in at least one interview which was made locally, there are only half a dozen people who feel really implied in the Caldas network !).

The Swiss node has already been presented as the ideal type of the closed position ; we will see up to what point this is anchored in the subconscious of the researchers with the following confession : when asked about the composition of the node and asked regarding the absence of

social sciences, somebody answered me : “yes, now it is possible to accept them because the projects are operational ”(sic !). And the nature of the opposition is also read in the fact that all the researchers of social sciences who enrolled at the beginning met later in the “Colombia Group”, an association that is engaged in social solidarity and of human rights ; but only one researcher of exact sciences, active in Caldas, has also dedicated to this organization. Then it is not a simple concern for efficacy what leads to wish to reject any social problem (and, by extension, the entire social science), but an election which forces to prefer science alone, and leave aside the problems of society. This reflection is significant also taking into consideration the few meetings organized by the node : “there are held among beneficiaries of scholarship to meet and help each other, but we have to be pragmatic : the students that want to enter, is not the important thing ! Now the projects are well structured, there is less need to meet”.

The network of the ideas or the network of human beings?

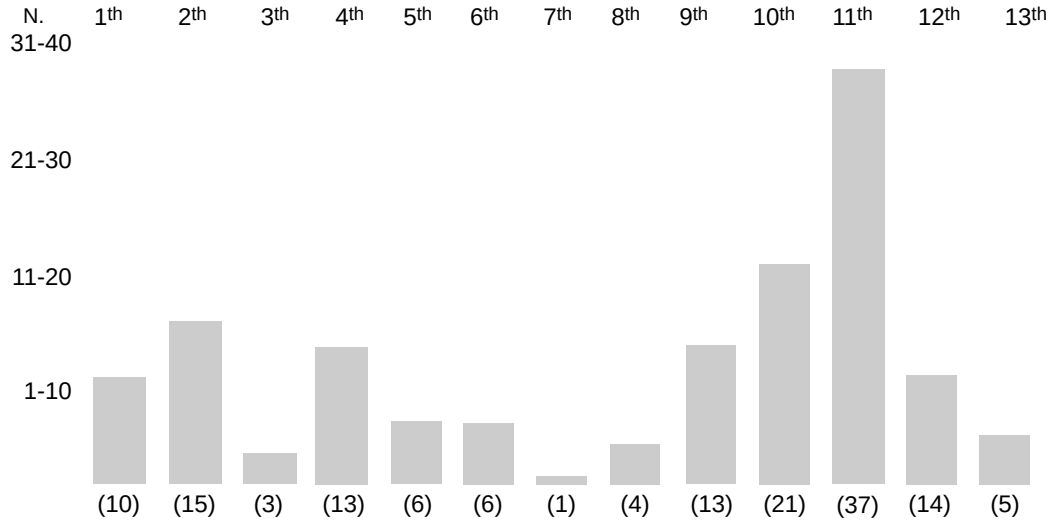
This statements by an active member of the Swiss node is particularly significant. The implied model is that where the node finally only serves to carry out what really matters : the development of scientific exchange. Perhaps it would be possible to do without it if the electronic network were well strongly settled in the habits, and it would be sufficient to have dialogues through the e-mail. This position is defended by one of the initiators of Caldas, one of the responsible people very close to Clemente Forero and one of the first coordinators of the node. It is naturally Carlos Moreno, researcher in computer sciences and robotics, recognized expert, whose positions are well known, specially thanks to the Caldas network, where he has stated them widely. It is even possible to talk about a Moreno tendency, since he is representative of a tendency according to which Caldas would be mostly a information science network, exclusively scientific, intended to the communication and to share knowledge with a strict minimum of administrative structure and management, considering the direction taken by the nodes as a dangerous tendency. Carlos Moreno is considered member of Caldas but not of a node. Besides the individual case, is this a future if not a probable future ?

This question could be debated in a theoretical manner, and to try to reject a perspective where research would no longer have the need of an anchoring in the concrete, physical, localized exchange, in context ; to question that the exchange of ideas may not depend on the place where these are generated, not to know any frontiers. But this is not the place for such a debate. It is better to see concretely how in the different nodes, their members think and use the tool of the Caldas network, the branch information science of the network.

This analysis is evidently supplementary to those that have already been made : it lies essentially in the members of the Caldas network who do not use the electronic mail. In effect, it supports itself on the interviews of the members of the different nodes ; but apparently, it is a majority of them who are not connected to Internet (it even seems that in Mexico there is no electronic communication of any type). And among those who are connected, many of them have not extended the number of their interlocutors since the time they became a part of Caldas. Even in Switzerland, where there is no lack either of the valued style of science or of the computer equipment, the Caldas network is not used much. It was a lot more at the beginning and permitted to it the web of the node, the initiation of projects, but since then the rhythm of exchanges went down noticeably, and we have been informed : “the Caldas network should be something different from a simple list-serv., but it is just that and in addition, not very efficient”.

On the other hand, in most cases, the electronic mail serves to request information (and still, not always of a professional nature !), but not to dialogue ; and the information only circulates form one individual to another and not in a chain. It is practically never used to communicate with other nodes (except on the part of those responsible for the nodes and by some individuals particularly adept to electronic communications), or to communicate with countries other then the country of residence, or with Colombia. An examination of the messages sent through the PECX electronic network (the New York node) from November 27, 1995 to May 8, 1996, is a good illustration. On the total of 255 messages, 148 (that is close to 60 %) are issued by one member of the PECX to the electronic list of the PECX and the remaining 107 came from abroad and were addressed to the group of nodes (that is, 27 from the Caldas network, 75 from Nodes/Euronodes, and 5 from the coordinator of the Swedish node). Regarding the internal messages, these also circulate in this PECX node and their density is extremely variable.
In fact, the period studied was particularly wrongly chosen, if an image of the average number of messages exchanged is desired. In effect, the first two peaks (second and fourth 15-day period) correspond to the exchanges for Christmas and New Years greetings, and the depression observed in the seventh 15-day period corresponds to university vacations. Regarding the peak that starts on the ninth 15-day period, it corresponds mostly to an exchange of messages of rejection or support, after a “politically incorrect” expression by the coordinator of the node who ended up by resigning ; if these messages are analyzed according to their content, it is found, in fact that 98 correspond in effect to the exchange or request of information on Caldas or on a scientific subject, but 22 had to do directly with the problem of the politically incorrect message ; and 50 correspond to concerns of a political, cultural or social nature (including Christmas messages).

As a general rule, and for the group of nodes, the tool has almost not been used. On the other hand, it is thought about it very positively and nobody would like to resign. Thanks to it contacts are established with Colombia and, in certain cases (New York), among members of the node, between meetings. But the consensus is practically unanimous to say that the electronic exchange would serve only to complete the verbal exchange, face to face, and not to replace it. The network has a snow ball effect, we were explained, but what matters is the Caldas network plus the node “since the contacts made through common relations are more real that those that are made only through the network”. A coordinator confirms us : “I transmit information to the group of the coordinators, but I only receive answers from those with whom I have previously established personal ties, whom I have already met, phisically”.



Number of internal messages in the PEXC electronic network,
each 15 days between Novembre 27, 1994 and May 28, 1995

A model that is not adopted as it is, but, nevertheless a widely positive balance

The model dreamt by some from the "virtual laboratory, in which the researchers are connected to each other, eliminating distance" (Nihon, Keizai, Shimbun, 1995) does not find its true realization in the Caldas network. The structure of communication of Colombian expatriate researchers is not similar, we have already seen, to a fishing net the web of which would encircle the world, but to a star that has Colombia as a center and a ray for each node. Does this model find its realization in any forum ? Without entering into this debate, we would like to quote the conclusions from a young researcher (Hert, 1995) which seem to us that pose the same problem as that evoked throughout this paper : "Electronic exchanges attempt to reach a consensus through a collective participation, but in fact, the electronic mail has mobilized as an individual promotion tool. Thanks to technical means, every subscriber has the same possibility to express himself but the debate submerges the participants in a social context, with all the cohort of inequalities that accompany it. This gap between technical possibility and the social use of tools, makes evident that the difficulty is not on the side of technique but on the side of social and human relations". For the same reasons -a favorable framework, material but also human, a network of personal relations, is one of the conditions necessary for productive research- and it is not enough to make the brains return in order to solve the problem of the brain drain, for the same reasons that it is not sufficient to make the ideas return. Neither the brains or the ideas move as autonomous entities, but require a favorable rooting in order to develop.

Otherwise, and to conclude, it seems to us unquestionable to consider that the experience has been a complete success. In order to give an idea, we can mention that it goes from the gap between the theoretical model that it had been the intention to develop and the reality observed as well as the gap between the number of members affiliated to different nodes and the effective number of participants in the meetings. The latter, according to the nodes, is from three to ten times lower. To conclude that the project has been a failure would be absurd : the important thing is that there are regular meetings with a certain more or less constant and loyal number of participants. And the case is that there are around a dozen people for the nodes where the number of members is of some importance, as if it were a maximum limit in order that the people would have the impression that they are really working jointly. And just so, the active members of the Caldas network have the feeling of working jointly, in an efficient manner and that they are doing something useful : for themselves, more or less directly ; for Colombia, always ; for the development of Colombian science, frequently ; and for the development of science, some times.

Every node, in fact, performs concrete activities. Among those that we have studied, with the exception of Switzerland and the smaller North American nodes, all of them publish regularly an information bulletin, which informs essentially about the scientific activities carried out, whether within the framework of the Caldas network or not, in Colombia, or in the country of residence. And it gives an account of the activities carried out by the node, or which are projected : conferences, seminars, meetings, round tables, courses about the use of computer tools, translation workshops, meetings of specific information (for the benefits of beneficiaries of scholarships, of people who have just arrived) and, naturally, presentation and report of the progress of projects.

And these represent the most visible results of the Caldas network. An operation such as Bio-2000 can not go by unnoticed ! We already talked extensively and therefore I am not going to extend in its description. But its places in the nodes is very central : several coordinators (Great Britain, Mexico, Sweden, Switzerland, Washington), consider that it is the foundation itself of their action. That their mission is to creation ties in order that the research projects will be car-

ried out jointly with Colombia (to serve as interface, to put the networks in operation, to interest the institutions of the country of residence) ; and that, once established, they will have fulfilled the essential part of their work. The set up of projects appears as the criterion for evaluation, and the condition of their survival, while the association : “a group, without a specific project, dies”, one of them used to tell us, and he referred to a “project” in the specific sense of a scientific research program, which connects his country of residence with his country of origin.

And those who participate in these programs acknowledge the role by Caldas in their development, either directly -without Caldas, certainly, some of us would have not existed- or indirectly : “it would no doubt would have been formed, it is an individual initiative, but it is not sure : Caldas has given the encouragement, the incitement”.

For all those who have contributed to the maintenance of these purposes, I believe that such purposes should be a repercussion in a gratifying manner ; for all the researchers of the south, they should be as words of hope.

[1] In fact, it has been possible to evidence recently that the countries which have encountered particularly high rates of “brain drain” are also those that have experienced relatively more rapid scientific developments. The role of expatriate Indian researchers in the development of cellular biology in India is an illustration of this, among others. Some attempts have also been made in some countries of the south to organize and connect the community of national researchers who live abroad to the national scientific community, around the scientific activities of a common interest. It is specially the case of South Korea, Taiwan, Singapore, Israel, India and China, to mention just a few. The People’s Republic of China which, up to recent events at the Tiananmen Square, did not consider the brain drain as an important problem, is struggling today for adopting strategies to attract researchers, rather than trying to benefit structurally from its group of expatriate scientists. Israel, closer to the Colombian case, since it seeks to organize the return of ideas and not of brains, also plays with other motivations different from the mere belonging to the national community. Many conferences have been organized in the last few years in numerous countries of the East (example : Rumania in 1994) but also of the South (example : Morocco in 1993) with the intention of getting together the group of expatriate scientists scattered throughout the world and of arising cooperation with the national scientific community. An important number of associations of expatriate researchers has been recently developed at the initiative of these researchers. A particularly dynamic example is that of the Society of Chinese Bioscientists in America (SCBA) which members passed from 200 in 1985 to 1500 in 1993. Non government organizations are also engaged in these efforts of mobilization of expatriate researchers. That is the case of the Academy of Sciences of the Third World and of the Third World Foundation of North America. The latter, sponsored by the University of Maryland in the United States, has undertakes the task of establishing a census of expatriate researchers who work in North American territory, starting with those coming from India.

[2] This project is object of an agreement with the National University of Colombia and has been placed under the double coordination of Jorge Charum, researcher/professor of that university, and Jean-Baptiste Meyer, researcher of ORSTOM, assigned to Bogota. It includes, also, in Colombia Jose Granés, Alvaro Morales, Alvaro Montenegro, Luz Stella Parrado and Carlos Murcia ; in Mexico, Nora Narvaez-Berthelemot ; in the United States Jacques Gaillard ; Dora Bernal in Austria ; and in France Bernard Schlemer (together with Jacques Gaillard).

[3] But what we just wrote means that when we talk about a Swiss-type node, this does not mean that there is a Swiss model of Caldas node, but that the Swiss node such as we have studied it at a given time, seems to represent a kind of ideal type.

[4] The person in charge of the node, who is in turn a physician, has started to open the node accepting researchers in social sciences, as well as claiming competences in other fields (such as environmental sciences for which Sweden has many capabilities to offer).

[5] Interview made by J.B. Meyer.

La dialectique du virtuel et du concret dans les « nœuds » de Caldas, le réseau de chercheurs colombiens expatriés

Bernard Schlemmer
Jacques Gaillard
Dora Bernal
Nora Narvaez-Berthelemot

Introduction

Pour les États qui n'appartiennent pas au groupe des « pays les plus riches », la maîtrise technologique et une compétence scientifique nationale représentent un enjeu de plus en plus crucial. Elles seules, en effet, sont à même de rendre le pays capable de s'adapter aux demandes d'un marché de plus en plus orienté vers une production à forte valeur ajoutée. Les stratégies de remontée de filière créent le besoin de techniciens, d'ingénieurs, de chercheurs qualifiés, capables d'innover et de maintenir leur pays dans le courant du progrès technique continu. Il est clair, en l'occurrence, que celui qui n'avance pas, recule.

L'affirmation que « la science est universelle », et que le savoir ne connaît pas les frontières, ne doit pas ici faire illusion. La proposition contient sa part de vérité, mais se heurte aussi aux réalités des rapports de forces, qui pénalisent les capacités scientifiques qu'un État démuni ne vient pas soutenir économiquement. On assiste même, aujourd'hui, à un divorce croissant entre une science mondiale de plus en plus privatisée -ce qui ne veut pas dire universelle- et des sciences nationales d'autant plus marginalisées qu'elles s'inscrivent davantage dans une logique d'urgence de retombées pratiques et d'intérêt local.

L'équipe de sociologues des sciences de l'IRD (ex-Orstom, « Science, technologie, développement » (Unité de Recherche 54, « Savoirs et Pouvoirs ») se donne pour ambition l'analyse de ces processus menaçants, et des réponses possibles qui y sont ou peuvent y être apportées, dans un souci à la fois de recherche scientifique et de coopération avec les pays du Sud. Nos recherches reposent sur la solidité de quelques hypothèses de travail :

- la science ne prend racine que lorsque le terreau social lui est favorable : il ne suffit pas qu'il y ait des scientifiques, et qu'ils aient des moyens, il faut en outre que ces chercheurs se sentent membres d'une même communauté ; celle-ci sera qualifiée par l'appartenance à une même profession, par le partage du même système de valeurs définissant celle-ci, et par l'appartenance à une même nation, justifiant également certains des choix qu'impose parfois l'exercice professionnel (choix d'un objet de recherche, d'un partenariat, d'un lieu de résidence, où le bénéfice escompté pour son pays l'emporte sur celui attendu en terme de déroulement de carrière) ;
- une telle communauté scientifique nationale implique, pour émerger ou se consolider, que ses membres aient le sentiment de rester maîtres de leur métier, même s'ils acceptent de répondre à des sollicitations relevant d'autres logiques, et qu'ils ne se distinguent ainsi des autres com-

munautés scientifiques que par des caractéristiques nationales définissant leur « style de science » - et surtout pas par un statut différent ;
- en même temps, le travail scientifique n'est pas préservé des conséquences du phénomène de mondialisation des échanges et de privatisation de la production et des services, ce qui accentue le désir des chercheurs du Sud d'appartenir au « collège invisible » mondial (Gaillard et Schlemmer, 1996), renforçant l'homogénéisation de la science au détriment des spécificités de recherche trop localisées pour être prises en considération sur le marché unique, « global » ;
- par contre, une communauté scientifique nationale n'est pas limitée aux membres résidant sur le territoire national : ceux qui ont émigré peuvent, pour autant, contribuer au renforcement des capacités scientifiques de leur pays ; et la science « utile » à un pays donné n'est pas non plus limitée à la science produite à l'intérieur de ses frontières.

Nous n'avons pas l'impudence de croire que nous sommes les seuls ou les premiers à avoir émis ces hypothèses. Bien au contraire, comme nul ne l'ignore, un nombre de plus en plus important de pays ont été amenés à repenser le problème de « l'exode des compétences » ou « fuite des cerveaux » (« *brain drain* » en anglais) en considérant, dans la mesure où ces mêmes chercheurs pourraient apporter au pays avec des compétences accrues, que le fait d'être formé et de travailler à l'étranger peut se transformer en un « gain » et cesser de n'être vu que comme une « fuite » -quand ce n'est pas comme une trahison. Il s'agit de créer une *communauté* scientifique *nationale*, sûre d'elle-même et revendicatrice, mais qui, en même temps, ne soit pas exclue du collège *scientifique* des pairs, de la compétence et de la compétition internationale [1].

C'est cette question -décisive pour la capacité des États du Sud à se maintenir dans le courant d'une science internationale- que nous avons voulu étudier, en nous attachant au cas « idéal-typique » de la Colombie, avec son « réseau Caldas » des chercheurs expatriés, mis en œuvre depuis 4 ans [2].

Le réseau Caldas représente sans doute la tentative la plus consciente et la plus élaborée de ce que nous avons appelé « l'option réseau-diaspora », et son succès représenterait sans conteste une chance, pour les petits pays du Sud en particulier, indiquerait une voie à suivre pour créer -ou recréer- une telle capacité scientifique malgré, ou plutôt : *grâce à* la grande dispersion géographique de ses chercheurs. Ce réseau associe les membres de la diaspora intellectuelle colombienne, entre eux d'abord, dans les différents lieux où ils vivent, ainsi qu'avec le pays lui-même et avec leurs pairs, à l'intérieur de celui-ci. Le réseau Caldas entend par conséquent être une extension de la communauté scientifique nationale hors des frontières, et un ancrage de celle-ci dans la science mondiale internationalisée. Pour un petit pays en développement, c'est là un déplacement considérable et une démultiplication significative de son potentiel de recherche. Une telle idée ne s'est pas imposée d'emblée : le réseau Caldas est né de la conjonction d'un outil -Internet-, des chercheurs expatriés qui surent l'utiliser entre eux -mais pas nécessairement à des fins scientifiques-, d'une instance politico-administrative nationale en charge de la recherche -Colciencias, qui souhaitait plutôt, au départ, le retour de ses chercheurs-, et d'un homme, Clemente Forero, alors directeur de Colciencias et qui sut théoriser et imposer l'idée maîtresse du réseau Caldas : sans les faire revenir au pays mais au contraire en profitant de leur insertion dans les meilleurs laboratoires, c'est simplement en reliant entre eux les chercheurs nationaux finalement les mieux placés -parce qu'au cœur du système-science- qu'il est possible d'*inverser* le sens des échanges, le pays du Sud se trouvant bénéficiaire, au bout du compte, sans que le Nord s'en soit seulement aperçu. Il existe un lien entre le flux des hommes et celui des idées, et le départ des uns peut être le meilleur moyen d'importer les autres.

Cependant, si le modèle semble convainquant, il reste que sa mise en œuvre concrète recèle, comme toujours dans les entreprises humaines, son lot de contradictions. La « science universelle » n'a de réalité que si elle prend racine dans une réalité concrète, locale, que dans son union avec une formation humaine spécifique (comme, inversement, les idées de telle ou telle formation humaine se sclérosent, si elle ne s'échangent et ne s'élèvent à l'universel). Il était donc important de voir comment cette idée de créer une communauté scientifique nationale virtuelle se vivait dans les « nœuds » locaux de ce maillage mondial des scientifiques colombiens.

Questions de méthode

Notre enquête sur le réseau Caldas a débuté pratiquement en même temps que le réseau Caldas. C'est un processus en train de naître que nous avons étudié. Le fait a son importance :

- il signifie d'abord que nous ne saurions présenter ici une « réalité » ontologique des nœuds, mais un simple instantané pris à un moment donné de leur évolution -une évolution encore très rapide et fluctuante. Ce que nous disons du nœud belge, par exemple, n'a aucune autre validité que celle-ci : à un moment donné, lorsque nous sommes allé l'étudier, ce nœud présentait telle configuration. Il est possible qu'à l'heure actuelle, celle-ci soit totalement transformée. Celle que nous décrivons a existé, et c'est tout ce que nous pouvons en dire.
- mais une organisation ainsi naissante implique également une grande fragilité face au contexte extérieur ; ses adhérents, ses dirigeants, par exemple, ont eu à réagir devant notre enquête, et cette réaction a toujours semblé, à l'observateur que nous étions et dont une « neutralité bienveillante » était la règle de conduite, quelque peu disproportionnée : soit qu'on se soit méfié de nous, qu'on se soit braqué et qu'on nous ait tenu à l'écart, soit au contraire qu'on ait attendu de nous la vérité sur soi, le soutien de ses désirs et le partage des mêmes inimitiés.

Nous avons connu les deux attitudes, la première moins souvent, et toujours suivie de la seconde, mais rarement nous fûmes vécus comme des observateurs non impliqués. Précisons cependant que si, en bonne épistémologie scientifique, nous aurions dû l'être, nous ne l'étions pas ! Nous n'étions pas vraiment neutres devant notre objet d'étude, et l'on n'aurait nulle difficulté à nous faire avouer que nous souhaitions la réussite de Caldas, que nous étions plutôt admiratifs devant l'ambition du projet et le travail déjà accompli, que nous avions la conviction de tenir là, pour objet d'étude, une initiative qui pourrait bien devenir un modèle, qui risque d'être à l'origine de transformations réelles dans le rapport de forces liant États non hégémoniques et science mondiale.

La question de la « neutralité du chercheur » est ici posée, mais nous savons bien, en sciences sociales plus encore qu'ailleurs, que l'observateur n'est jamais neutre et que son premier devoir est d'en être conscient (en ce sens, nous avions la tâche bien facilitée). Et si notre regard était un peu plus que « bienveillant », nous étions loin des problèmes de la recherche-action. Nous n'étions pas là *pour* intervenir, nous n'avions pas de plan d'action ni d'objectifs politiques (*policy*) à atteindre, nous n'avions pas d'idée préconçue sur le processus qui « devait » se poursuivre, son rythme, son développement, son orientation. Nous découvrions une réalité en train de se faire sous nos yeux, nous l'observions en train de naître, au lieu de vouloir la transformer en une autre réalité pré-donnée, pré-connue (même si nous sommes toujours plein d'espoir quant au cours qu'elle va prendre...).

Ce n'est donc pas le droit que nous aurions eu ou non d'orienter le processus en cours qui pose ici tellement problème, que la portée des conclusions qui pourraient en être tirées. La première question se résoud d'évidence : au nom de quelle valeur, de quelle morale nous contesterait-on le droit de nous sentir solidaire d'une initiative allant dans le sens d'un monde plus égalitaire, d'une plus grande maîtrise, par des pays défavorisés dans la compétition en cours, de leurs atouts scientifiques ? Mais la seconde indique le risque qu'il y a à généraliser des conclusions sur la réussite d'un processus en masquant le fait qu'il s'est réalisé, en partie, grâce à un concours extérieur qui aura orienté sa dynamique.

Prenons un exemple : cette contribution porte notamment sur le décalage certain qui existait entre le modèle de réseau dominant dans le discours officiel sur Caldas, et le modèle réellement mis en œuvre dans les différents nœuds. Dans le modèle officiel, la mise en place du forum électronique R-Caldas permet au Colombien d'entrer dans un monde de la science devenu un village : la distance est abolie et chacun peut dialoguer, en voisin, avec chacun. Dans les faits,

le monde est peut-être un village, mais alors, il faut bien admettre que peu de gens se retrouvent sur la grand-place, que le dialogue se limite à la maison familiale, dont les volets sont sans doute entr'ouverts, mais dont la porte est close ! Cette constatation nous a amenés à poser systématiquement, dans les entretiens que nous avons eu avec les membres des nœuds que nous étudions, la question des connexions qu'ils établissaient ou non avec des scientifiques, Colombiens ou pas, en Colombie, dans leur pays de résidence, ailleurs, n'importe où... Ce faisant, il est bien évident -et ce nous fut parfois dit, spontanément- que nous leur ouvrions (ou leur rappelions) des horizons nouveaux, des opportunités auxquelles ils n'avaient pas encore (ou pas souvent) songé, et que nous avons donc contribué quelque peu au décloisonnement de ce village-monde.

Ne nous leurrons pas sur notre influence, sans aucun doute assez minime ! Il n'en faut pas moins souligner ceci : c'est parallèlement que s'est déroulé, orienté et réorienté le processus de construction du réseau Caldas et de ses nœuds, et que se construisait sur lui notre discours, qui a pu en orienter le cours, le conforter ou le gauchir. Ceci valait la peine d'être précisé d'entrée de jeu.

Deux précisions encore :

- nous avons garanti l'anonymat, et nous le respectons. Quand l'interviewé est un l'un des animateurs officiels du réseau, et que les propos rapportés nous ont paru avoir un lien avec ses responsabilité, il peut être cité, soit que nous ayons pensé à le prévenir avant, soit que nous lui ayons soumis, pour vérification, le texte de l'interview.
- Nous développons nos observations à partir des cas que nous avons pu observer : Autriche, Belgique, États-Unis, France, Grande-Bretagne, Italie, Mexique, Suède et Suisse. Certains ont été plus suivis que d'autres, et surtout, l'enquête n'est donc pas exhaustive. Le fait, par exemple, que nous ne mentionnions jamais le nœud espagnol ne signifie en aucune façon qu'il n'existe pas, ou qu'il soit insignifiant !

La grande variété des nœuds

Chaque nœud local possède ses caractéristiques propres, dues à l'histoire de sa constitution, à la population de sa diaspora, etc. Celle-ci est parfois extrêmement volatile (c'est le cas des nœuds de pays où la population colombienne intéressée à la science est essentiellement composée de jeunes doctorants, qui se renouvellent trop vite pour qu'une cristallisation s'opère autour de quelques figures fortes), et un même nœud peut ainsi présenter, à quelques mois d'intervalle, une configuration radicalement différente. En outre, une « crise » interne peut aussi transformer un nœud en profondeur, simplement parce que change l'équipe de direction.

Parmi ceux que nous avons particulièrement observé, il est possible de dresser une sorte de typologie, en fonction de leur « degré d'ouverture » et selon deux axes dont l'un -l'ouverture externe- me paraît contingente, mais dont l'autre -l'ouverture interne- touche à un opposition plus fondamentale, au *style de science* que l'on veut mettre en œuvre [3] :

Ouverture vis-à-vis de l'extérieur ou consolidation interne

Le premier axe, en effet, oppose ce que j'appellerai les nœuds « exo-centrés » et « auto-centrés ». Aux extrémités de cet axe, on peut citer le nœud britannique, d'un côté, et belge de l'autre. Tous deux sont entreprenants, créatifs, tous deux mêlent apparemment sans tensions sciences dures et sciences humaines, activités d'intérêt général et activités scientifiques ciblées.

Mais l'un, le nœud belge, est très actif dans la tentative d'organiser le réseau Caldas à l'échelle européenne, très soucieux de se décloisonner. Il offre à qui veut en profiter sa compétence à démarcher auprès de la Communauté Européenne, et souhaiterait en échange voir s'élargir un horizon que la dimension de son pays d'accueil lui fait paraître un peu bouché : la Belgique est à la fois un petit pays, où les Colombiens ont du mal à trouver la « masse critique » de chercheurs en laquelle s'immerger, et le pays qui abrite le siège de l'Union Européenne, dont les arcanes permettent, à qui sait les déchiffrer, d'accéder d'emblée à une dimension internationale. Le coordonateur consacre donc une part importante de son temps à convaincre ses homologues européens que la constitution -au moins à usage externe- d'une confédération régionale des nœuds Caldas n'aurait que des avantage : parfois, explique-t-il, chaque nœud fait le même travail (diffusion de l'information, par exemple), et un « Bulletin » de liaison européen représenterait un gain de temps appréciable ; pour coopérer avec l'extérieur, mieux vaut se présenter ensemble, faire poids ; il existe d'ailleurs des appels d'offre qui font obligation, pour souscrire, de coordonner les laboratoires de plusieurs pays, et l'on serait alors mieux placé... La réunion qu'il a organisée sur ce thème a connu un très grand succès, et il semble avoir convaincu, en particulier les coordonateurs des nœuds français, italien, et suisse également. Mais pas tout le monde.

En effet, une attitude inverse prévaut en Grande-Bretagne, où le coordonateur semble avant tout soucieux de structurer plus fortement son propre nœud, et ne songe guère à ce qui se passe sur le continent. Le nœud britannique se montre ainsi fort peu désireux de correspondre avec l'extérieur : les liens sont créés avec la Colombie, bien sûr, comme avec les chercheurs du Royaume Uni, mais l'ouverture n'est pas probante -tant s'en faut- avec les scientifiques des pays voisins, fussent-ils Colombiens ; par exemple avec le nœud belge, justement, si proche pourtant, et qui est très demandeur ; ou avec le nœud français, pays dans lequel le responsable du nœud de Grande-Bretagne avoue avoir séjourné récemment, sans chercher à y rencontrer ses collègue colombiens ; ou encore avec le nœud suédois, qui n'a pas eu le sentiment que sa visite aux Colombiens de Grande-Bretagne ait mobilisé grand monde que son passage leur ait paru représenter une opportunité pour le développement de la coopération scientifique des Colombiens expatriés.... Nous n'avons pas ici, comme pour la Belgique, d'explication immédiate : faut-il incriminer l'influence britannique et sa tradition du « splendide isolement » ?

Ouverture ou fermeture des sciences dures

Le deuxième axe oppose les nœuds les sciences dures se trouvent seules représentées, et les nœuds où participent des non scientifiques ;. dans certains nœuds, les chercheurs de sciences dures ont, pour ainsi dire « pris le pouvoir », qu'ils n'entendent pas -inconsciemment au moins- partager avec les sciences humaines, considérées comme non scientifiques, moins encore avec les tenants d'un militantisme culturel et social, ce qui dévoierait l'essence même du projet Caldas ; dans d'autres au contraire, les activités scientifiques ne sont même pas dominantes.

- Le nœud suisse, par exemple, est l'un des plus dynamique pour la mise en œuvre de projets scientifiques internationaux liant chercheurs colombiens travaillant dans des laboratoires helvétiques, chercheurs colombiens restés au pays, et chercheurs étrangers, suisses ou non ; mais il reste très centré sur les sciences « dures » : les sciences humaines n'y trouve guère leur place, et moins encore ceux pour qui la recherche scientifique représente un centre d'intérêt, mais qui ne font pas profession de chercheurs. Même les chercheurs de sciences dures, mais qui ne sont pas impliqués dans un projet concret de recherche liée avec la Colombie se sentent plus ou moins exclus. Le noyau de chercheurs actifs étant assez stable, il s'agit là d'une tendance lourde : elle existe depuis l'origine du nœud, s'est rapidement concrétisée par la désaffection d'un nombre important de membres, qu'on ne pensait d'ailleurs pas à retenir -pas même à prévenir, lorsque se tenait une réunion générale, tant la préparation des projets occupait l'esprit des

membres actifs. Cette situation nous a d'ailleurs été révélées par ces derniers qui, en septembre 1994, en avaient parfaitement pris conscience, jugeaient lucidement cette pratique comme une dérive dangereuse, et s'apprêtaient -nous ont-ils affirmés, visiblement en toute sincérité- à définir les moyens d'une plus grande ouverture. Un peu plus d'un an après, nous avons retrouvé la même situation. Dans le même registre, certains nœuds font preuve d'une concentration dans un domaine particulier, comme les sciences médicales pour le nœud suédois, à Stockholm, dont la majorité des membres sont professionnellement insérés au sein du prestigieux institut Karolinska [4].

- A l'inverse, le nœud New Yorkais -dont le responsable fut longtemps, et jusqu'à récemment, une musicienne, chef d'orchestre- compte une forte proportion de Colombiens qui ne sont pas des chercheurs, mais des artistes, des littéraires, des professions libérales, etc. On ne s'étonnera pas d'apprendre que ce nœud ne développe pas seulement des échanges scientifiques, mais toutes sortes d'activités sociales et culturelles (entraide, etc...). Ce nœud vient de changer de responsable, un scientifique succédant à une artiste. Cela va-t-il modifier ses activités, et jusqu'à quel point ? La grande convivialité de ce nœud -le plus actif de ceux qui se sont constitués aux USA, mais peut-être pas sur le plan scientifique- rend son évolution d'autant plus intéressante à observer, mais il est beaucoup trop tôt pour en deviner le sens.

Le nœud français apparaît comme plus équilibré, mais c'est peut-être parce que c'est l'un de ceux que nous connaissons le mieux. Et encore une fois, c'est actuellement, à ce moment de son histoire, que nous le disons tel. Si notre description se rapportait au moment où nous avons débuté l'enquête, en effet, nous noterions son importante représentation de chercheurs en sciences sociales... mais nous ajouterions que c'était au prix de tensions certaines avec les chercheurs en sciences exactes : ceux-ci avaient alors l'impression que le nœud y perdait son âme, sa spécificité et -du point de vue des retombées qu'ils en attendaient personnellement- son intérêt... au point même que certains quittèrent alors l'association. Intervenus plus tôt, peut-être aurions-nous au contraire parlé d'une domination des sciences dures ? Un changement de la direction a profondément modifié le paysage et, trois ans après et grâce au renouvellement constant des membres, dû aux arrivées et aux départs des doctorants, il ne reste plus trace d'une opposition sciences dures sciences sociales, sinon dans la mémoire des anciens.

Aucun nœud n'est donc jamais « figé » dans la typologie esquissée ci-dessus.

Des conjonctions historiques particulières

C'est que les caractéristiques qui spécifient chacun des nœuds du réseau Caldas sont le résultat de la conjonction d'une double histoire, et de son articulation : l'histoire « officielle » du réseau, d'une part, l'histoire des Colombiens expatriés d'autre part.

Le réseau Caldas, une politique nationale et volontariste...

Il y a une pré-histoire, au réseau Caldas. En 1970, en même temps d'ailleurs que naissait l'ACAC (Association colombienne pour l'avancement de la science), Colciencias (le fonds colombien de recherche scientifique et de projets spécifiques) et l'Icfes (l'institut colombien pour le développement de l'enseignement), tous deux créés en 1968 (avec le Concyt, Conseil national pour la science et la technologie), ont réunis, également sous l'égide de l'OEA, un groupe d'experts en documentation scientifique. Ceux-ci concluent à la nécessité de « prendre en compte le concept de réseau d'information et de documentation qui lie les bibliothèques et

les centres d'information et de documentation afin de permettre : l'accès et l'utilisation collectifs des patrimoines dispersés, l'utilisation rationnelle et économique de la technologie à travers de systèmes automatises de communication, une utilisation plus rationnelle des ressources disponibles en professionnels et en spécialistes de l'information, une plus grande facilité de transfert technologique et l'assimilation des nouveaux concepts d'ingénierie de système et de programmes coopératifs » (Hurtado-Galvan, 1993, p. 205). On peut lire ce texte en pensant « laboratoires » en lieu et place de « bibliothèques », « résultats scientifiques » pour « informations » et « patrimoines » ; enfin « chercheurs expatriés » remplacerait « ressources disponibles ». On voit que tout, ou presque, est déjà là : la récupération d'un savoir collectif dispersé, via les technologies de réseau informatique, en vue de développer des projets de développement scientifique en coopération.

Encore fallait-il s'en rendre compte, et accepter d'ouvrir le pays à l'extérieur. On peut faire remonter l'ouverture de la Colombie à la fin des années 1980, mais ce fut le très grand mérite d'un homme, Clemente Forero, Directeur de Colciencias, d'avoir compris que l'important n'était peut-être pas tant d'assurer le retour en Colombie des chercheurs expatriés (pas plus, pour poursuivre l'analogie, que l'important aujourd'hui n'est de disposer physiquement de tous les ouvrages dans sa bibliothèque), mais de faire en sorte qu'ils agissent de l'extérieur pour la Colombie, qu'il fassent profiter leur pays de leur insertion dans les laboratoires où ils travaillent, du réseau de relations scientifiques qu'ils auront su constituer. Peut-être même ne pensait-il alors -c'est ce qui nous fut rapporté par l'un de ceux qui l'accompagnèrent dès le début de cette aventure- qu'à un réseau avant tout informatique, dont les « nœuds » n'auraient été constitués que de deux à trois personnes en chaque point central, pour canaliser et rediffuser l'information. Un « tour du monde » fut alors organisé, en 1992, durant lequel Clemente Forero exposa son idée aux Colombiens qu'on avait réussi à rassembler, le plus souvent avec le concours de l'ambassade, en s'appuyant sur des associations colombiennes préexistantes, ou par le biais et le hasard de relations personnelles. Le charisme incontestable du Directeur de Colciencias fit le reste : les nœuds du réseau Caldas naissaient les uns après les autres, au fur et à mesure que se déroulait son périple...

Colciencias ne se contentera pas de donner ainsi l'impulsion initiale, mais poursuivra sa politique volontariste pour le développement de Caldas : c'est Colciencias qui financera, au moins un temps (de six mois renouvelés une fois, en général), le lancement des nœuds, qui demandera aux ambassades et consulats d'apporter leur concours à cette initiative (notamment en les abritant), qui suggérera fortement aux étudiants candidats à une bourse de formation à l'étranger de s'inscrire sur place au nœud local de Caldas, qui demandera à tous chercheur colombien effectuant une mission dans un pays où n'existe pas encore de nœud, de parler de Caldas et de mobiliser la communauté scientifique locale, etc... (Pour autant, il ne faudrait pas croire que Caldas ne soit que l'un des service administratif de Colciencias ! Il s'agit tout au contraire d'un projet extrêmement décentralisé, souple, autonome, avec un minimum de structuration verticale. Mais il est vrai qu'une certaine ambiguïté demeure, nous aurons à y revenir).

...répondant à une attente

Il ne suffisait pas que la Colombie s'ouvre enfin à l'extérieur et aux Colombiens de l'extérieur ; il importait aussi que les Colombiens de l'extérieur s'ouvre à l'idée de travailler avec le gouvernement colombien, et de travailler comme scientifiques avec la Colombie. « La constitution du réseau Caldas de chercheurs à l'étranger (...) ne peut se concevoir qu'en tenant compte des divers facteurs qui convergent à un moment historique déterminé. Le premier d'entre eux est la volonté des secteurs de la diaspora (...) de travailler depuis leur lieu de résidence en faveur du développement du pays » (Granes, Meyer, Carillo et Murcia, 1995, p.1). Le désir était latent, et ne demandait qu'à s'exprimer. La conjoncture politique, en Colombie, s'était sensiblement

modifiée, et montait le désir de participer à ce processus, de se sentir Colombien « à part entière ». En février 1990, un jeune physicien basé au CERN (le centre international de recherche sur l'énergie des particule, à cheval sur la frontière franco-suisse), Fernando Rivera, lance sur une messagerie électronique un appel disant son désir de contacter d'autres colombiens... et reçoit pas moins de 15 réponses en un jour. Ainsi naît une *list-serv*, institutionnalisée en 1991 sous le nom de COLEXT (Colombiens de l'extérieur), qui se trouvera réunir immédiatement environ un demi-millier d'abonnés. C'est sur COLEXT que Colciencias diffusera sa « Lettre » d'information, lancera un débat sur la nouvelle politique scientifique, préparera le voyage de Clemente Forero, c'est de COLEXT que naîtra la R-Caldas, en janvier 1993.

Des caracactéristiques locales

Tel est le schéma d'ensemble, la conjonction de facteurs qui ont permis la naissance et le développement de cette entreprise. Localement, celle-ci s'appuie en outre sur des configurations diverses.

- En l'État fédéral d'Allemagne, par exemple, la recherche est très liée aux Universités qui abritent les laboratoires, et plus encore, au « Professor » dont il dépend ; il ne s'est pas constitué là un « nœud » allemand classique, mais plutôt une sorte de fédération de micro-nœuds, chacun relié à son université propre.

- En Autriche, un groupe de Colombiens résidants à Vienne s'était constitué dès 1989, sous le nom de La Casa Cutural, avec son journal, La Chiva, et ses groupes de travail, dont un groupe « informatique » et un groupe « informations » s'intéressaient particulièrement à l'informatique : à peine peut-on dire qu'un « nœud » s'est créé : c'est seulement ce groupe qui, découvrant l'existance de Caldas, a décidé d'orienter et de développer davantage leur activités en direction du milieu scientifique.

- A New-York non plus, on n'a pas attendu la création de Caldas pour créer Pecx (Professionnels et étudiants colombiens de l'extérieur) l'association qui constituera le nœud ; elle est née d'un débat qui occupait nombre des messages sur Colext, au sujet de l'expatriation des chercheurs : fallait-il les considérer comme des « traîtres à la patrie » ? (en résumant, nous caricaturons, bien sûr, mais le thème portait bien là-dessus). Un groupe de chercheurs et d'étudiants, un peu plus d'une vingtaine, se réunirent pour en débattre, en novembre 1991, et l'idée de l'association s'est vite imposée : tous ont mis sur la table un billet de 10 dollars chacun, pour cotiser, et Pecx était née.

- Ailleurs, comme à Houston (États-Unis), c'est aux hasards des changements de résidence que l'on doit la constitution récente d'un nouveau nœud : il se trouve que deux des membres fondateurs de Pecx (le nœud new-yorkais) se sont établis là en 1993...

- Il est des lieux (Paris, Londres, Washington...) où la constitution d'un nœud a pu s'appuyer sur des chercheurs colombiens qui se connaissaient déjà, comme militants d'une même association scientifique colombienne ou plus, largement, latino-américaine, mais qui ont, pour autant, développé un nœud spécifique ; dans d'autres pays (Belgique, Italie, Suisse...), seules des associations culturelles ou sociales, voire directement politiques, s'offraient aux chercheurs Colombiens expatriés, qui n'avaient donc aucune expérience de ce que peut être une association à but scientifique.

- Partout où Clemente Forero est passé, il a, au moins dans un premier temps, su déclencher l'enthousiasme et mobiliser les énergies, même parmi les plus réticents à collaborer avec une instance colombienne institutionnelle («oui, mais lui, c'est un scientifique, pas un bureaucrate, il comprend la pratique et les logiques de la recherche », nous a dûment expliqué l'un d'eux) ; mais il y a des lieux où Clemente Forero n'est pas passé.

- Autre facteur : dans certains pays (Belgique, Mexique), l'ambassade a su apporter un soutien particulièrement actif, imaginatif, efficace ; d'autres où celle-ci, sans doute moins motivée, ou peut-être moins libre de son temps, s'est contentée de mettre un local à la disposition du nœud...

Pourtant, s'il est certain que chacun de ces facteurs a dû peser dans la configuration spécifique de chaque nœud, force est de constater que ce n'est pas de façon ni évidente, ni univoque. Dans certains cas, comme en Grande-Bretagne par exemple, la conjonction de facteurs *a priori* favorable (préexistence d'une association scientifique, passage de Clemente Forero, appui de l'ambassade) n'a pas empêché le nœud de ne s'institutionnaliser que lentement : la première réunion, organisée au consulat et en présence de Clemente Forero, eut lieu en avril 1992 ; la première Assemblée générale, réunissant plus de 80 personnes, en janvier 1993, et la première élection du comité exécutif, en février 1995 ! Dans d'autres à l'inverse, comme en Suède notamment, l'inexistence d'association scientifique susceptible de regrouper les chercheurs Colombiens, le fait que Clemente Forero ne soit pas venu lui-même, sans compter la relative faiblesse des effectifs, n'a pas empêché le nœud d'exister rapidement et de fonctionner correctement.

En général, l'enthousiasme de la première réunion est général (le coordinateur du nœud suisse me déclare avec humour avoir pratiquement découvert à cette occasion qu'il n'était pas le seul Colombien en Suisse !) ; mais, en Suisse, c'est très rapidement que tous les chercheurs de sciences humaines ont disparu ; mais au Mexique, c'est dès le début qu'à chaque nouvelle réunion, le nombre de participants fondait comme ice-cream au soleil (avant que la nomination d'un coordonateur ne vienne donner à ce nœud le minimum de stabilité indispensable, avec désormais régulièrement de 8 à 10 participants) ; mais en Californie, la personne chargée de déposer les statuts de l'association dont la création est alors décidée... disparaît dans la nature sans laisser de trace !

Il n'est pas jusqu'à l'Acastc (Association des chercheurs pour l'avancée des sciences et des techniques en Colombie), le nœud français, sans doute l'un des plus dynamique et des plus solides, dont les débuts n'aient été rapidement marqués par une période de découragement, de scepticisme, de déception face aux discours très idéalisés de Clemente Forero, alors que rien de concret ne semblait en sortir... ce qui montre bien à quel point il serait absurde de classer aucun nœud comme destiné à bien marcher ou à péricliter. Mais cela montre aussi que la question est bien de comprendre ce qui a fait la mobilisation des Colombiens de l'extérieur autour du développement de la science, et comment maintenir ce militantisme ?

Questions de mobilisation...

Car le modèle d'identification proposé repose *à la fois* sur le postulat d'une science universelle -il faut donc laisser les chercheurs colombiens dans les laboratoires du Nord- et sur le patriotisme de ces chercheurs : ils doivent se sentir Colombiens, se mobiliser, militer, pour que le réseau fonctionne. On pourrait supposer que la plupart des chercheurs Colombiens expatriés auraient cherché à justifier à leurs propres yeux leur départ en s'intégrant exclusivement dans le groupe professionnel d'accueil, gommant autant que possible leur appartenance à un pays scientifiquement quelque peu marginalisé (marginalisé par rapport aux grands centres géographiques où s'élabore la science actuelle, comme par rapport aux thématiques et aux styles de science qu'imprime ce *mainstream*) ; la communauté scientifique colombienne préexistait à leur départ mais, vu le nombre de ceux-ci, c'est une communauté éclatée et déracinée qui aurait pu survivre ; or, le paradoxe intéressant est bien au contraire que c'est *à partir de* la diaspora que, pour nombre des Colombiens « de l'extérieur », semble avoir pris naissance ce fort sentiment d'appartenance communautaire à un groupe professionnel national.

Dès le lancement du projet, l'un de ses promoteurs expliquait ainsi à l'un d'entre nous [5] que, parmi les raisons expliquant la mobilisation et l'enthousiasme des Colombiens pour Caldas, il y avait d'une part l'ampleur de la rupture historique que représentait l'actuelle ouverture de la Colombie («on ne pouvait se définir que « contre », on peut enfin exister en étant « pour » ; d'où l'ampleur du mouvement d'adhésion ») ; d'autre part, la possibilité qui leur était offerte d'être des acteurs, des créateurs de réseaux, et non de simples éléments d'un réseau pré-existant, de « générer des engrenages et non plus d'être de simples rouages ». Avant Caldas, les chercheurs s'engageaient dans des associations culturelles ou sociales, de défense des droits de l'homme, voire purement politiques ; mais nombre d'entre eux ne s'y retrouvaient pas totalement, et ces associations consommaient beaucoup d'énergie, sans qu'on en voie toujours les résultats concrets. « La science leur donne un terrain de neutralité, au-delà de divergence militante », poursuit le même responsable déjà cité. On retrouve un « nous, les Colombiens », gratifiant parce qu'immédiatement lisible à l'extérieur, et lisible positivement ; on y trouve une identification sur des actions qui marchent.

Dans le même ordre d'idée, le coordinateur du nœud français explique par ce besoin de se raccrocher à la « colombianité » le succès de l'Acastc par rapport aux autres associations qui lui pré-existaient en France. L'ALAS par exemple (Association latino-américaine de scientifiques), regroupe des chercheurs d'Argentine, du Brésil, du Chili, etc.. Par ses objectifs et ses méthodes, c'est l'association la plus proche de Caldas : sans froisser personne, on peut tout de même dire qu'elle ne montre pas le même dynamisme. Pourtant, elle a des atouts : son siège est à l'Unesco, elle a développé d'excellents réseaux de relations avec les scientifiques d'Amérique du Sud. Mais le sentiment identitaire, mobilisateur, s'y trouve davantage dilué, dans une appartenance régionale et non nationale ; en outre, cette association, créée en 1981, est composée de chercheurs pour la plupart maintenant bien insérés, professionnellement, et qui développent un patriotisme moins militant.

Il faut cependant distinguer ici ce qui domine, chez les Colombiens de l'extérieur qui se retrouvent dans le réseau Caldas : le sentiment d'appartenance à la communauté nationale, s'organisant sur un plan scientifique, ou le sentiment d'appartenance à la communauté scientifique, s'organisant sur un plan national ? Car plus ils se sentiront Colombiens, plus ils se sentiront mobilisés par l'idée d'aider le pays, sans doute, mais plus ils céderont à la tentation de transformer le réseau en une association d'échange et d'entraide, diluant son potentiel strictement scientifiques -et perdant leurs collègues qui refusent de perdre de vue qu'il s'agit d'un réseau *scientifique*. A l'inverse, plus ils se considéreront comme des scientifiques, plus ils voudront faire du réseau Caldas un réseau scientifique *international*, privilégiant l'échange avec leurs pairs, et sans trop se préoccuper de retombées sur les collègues un peu trop hors de leur champ, et dont ils ne voient pas pourquoi il faudrait s'encombrer sous prétexte qu'ils sont Colombiens : la science n'a pas de frontière.

Or la réponse donnée par les interviews que nous avons pu mener est très nette : c'est le premier cas de figure qui est largement dominant, même si l'autre se trouve également représenté.

Pour ces derniers - « scientifiques d'abord »- Caldas doit avant tout se développer autour de projets scientifiques concrets. D'ailleurs, si l'on ne voit pas de retombées possibles de l'investissement en temps réellement considérable que l'on consent en étant membre actif de Caldas, il est inutile d'espérer maintenir aucune mobilisation, expliquent-ils. Par contre, créer des projets, c'est à la fois le meilleur moyen d'aider la Colombie, le seul moyen de le faire en restant dans son lieu de résidence, ça développe les échanges avec d'autres scientifiques et donc, ça améliore le savoir-faire des scientifiques Colombiens ; enfin, c'est le seul moyen de maintenir un lien avec le pays, à la fois scientifique et sentimental (retrouver « l'odeur de la goyave » dont parle Garcia-Marquez, garder un lien avec la culture, la langue, le sentiment communautaire).

Pour les autres, les plus nombreux, semble-t-il, c'est au contraire ce besoin de rétablir, ou de créer, ce lien avec la Colombie qui représente l'aspect le plus gratifiant, celui qui permet, là

aussi, de consentir une dépense d'énergie considérable pour animer le nœud. Et si les « scientifiques d'abord » parlent surtout des projets dans lesquels ils s'investissent en Colombie, et des échanges qu'ils développe à leur propos sur le réseau électronique (R-Caldas), pour les « Colombiens d'abord », c'est le nœud qui prédomine, l'enracinement local, où la Colombianité se voit physiquement, dans toutes les discussions spontanées et pas seulement dans l'aspect scientifique programmé. « Sur la R-Caldas, il faut être scientifiquement vraiment solide pour se dire que l'on apporte quelque chose à la Colombie ; dans le nœud, c'est différent. S'il ne s'agissait que de science, il suffirait d'être un bon chercheur, et d'être sur le réseau ; dans le nœud, en plus, on milite, on travaille à l'amour de la Colombie ». On ne s'étonnera pas de trouver dans ce cas de figure les chercheurs en sciences sociales, souvent par ailleurs les plus engagés dans la vie socio-politique colombienne : « parler de sciences sociales, dans le contexte latino-américain, c'est forcément faire avancer la démocratie, parce que c'est parler de la société, de problèmes sociaux, de politiques ».

La priorité donnée à l'engagement vis-à-vis de la Colombie, où le caractère scientifique est second, est confirmée par ce que nous avons pu apprendre des chercheurs Colombiens qui ne se mobilisent *pas* pour la Colombie, pas plus comme scientifique à Caldas, que comme Colombiens dans toute autre association socio-culturelle : le motif invoqué est presque toujours la nécessité de se consacrer à ses études, le refus de consacrer du temps à autre chose -le travail est ici présenté comme un investissement indispensable ; rarement, très rarement, on évoquera le sentiment que c'est se dévouer pour le pays qui est une perte de temps un peu inutile.

Au cours du colloque « Les sciences hors d'Occident au XX^{e} siècle », dans l'atelier consacré aux migrations scientifiques, il y eut un échange entre Virginia Cano, qui se demandait l'impact que pouvait avoir sur la communauté scientifique colombienne le fait que l'Espagne tente de faire revenir les chercheurs de Colombie qui sont d'anciens exilés -ou les descendants d'anciens exilés- de la guerre civile, et Clemente Forero, qui lui répondit que cela n'aurait strictement aucun impact, puisqu'ils seraient toujours connectés au réseau Caldas et que peu importait où se trouvaient les chercheurs, du moment qu'ils étaient inter-connectés. Si je peux participer avec quelque retard au débat, je dirais, à la lumière de ce que l'on vient de voir du militantisme des chercheurs colombiens, que la réponse de Clemente est insuffisante : ces Colombo-espagnols ne continueront, en fait, à communiquer sur la R-Caldas que pour autant qu'ils se considéreront toujours membres du collège invisible des chercheurs colombiens, que pour autant qu'ils continueront à se sentir Colombiens. Peu importe, en effet, qu'ils soient en Espagne ou ailleurs... sauf si, à l'occasion, ils se découvraient Espagnols !

... et de démobilisation

On comprend désormais les raisons profondes de l'enthousiasme qu'a suscité le lancement du réseau Caldas. La quasi totalité des interviews de Colombiens ayant vécu cette période parle de cette très forte mobilisation, du climat passionné qui régnait alors, de l'impression, justement, que se constituait une identité collective valorisante, améliorant l'image du pays. Pour un scientifique colombien expatrié, l'aveu de sa nationalité lui peinait, renvoyant trop facilement au stéréotype « Colombie = drogue ». Désormais, il s'en réclamait, fier d'expliquer ce qu'était Caldas, plus fier encore de n'avoir pas besoin de l'expliquer, l'existence du réseau comment à se répandre, comme une initiative originale et passionnante.

Mais pour qu'une organisation humaine se pérennise, il faut qu'à l'enthousiasme dans l'instant succède la conviction dans la durée. Et pour cela, qu'on ait le sentiment que les efforts consentis aboutissent à des résultats certains, et gratifiant pour soi (que ces résultats et ces gratifica-

tions soient matériels ou du symboliques). « Le programme de rapatriement des scientifiques et des programmes Colciencias de développement des stages, de bourses d'études à l'étranger, et finalement les projets de travail en commun sont l'expression de la comptabilité des intérêts », écrivent à juste titre J. B. Meyer et J. Charum (1995, p.1012) pour décrire le modèle de Caldas. Mais ces intérêts, pour être compatibles, n'en risquent pas moins, comme tout intérêt, d'être déçus et, entre le modèle et la réalité, il peut y avoir une marge par où va se glisser la démobilisation. Et d'autant plus que les attentes étaient grandes : c'est pourquoi le phénomène fut à peu près général, même s'il saura le plus souvent se résorber par la suite.

Les Colombiens étaient certes prêts à admettre que c'est aux membres de Caldas de faire quelque chose pour la Colombie, pas à Colciencias de faire quelque chose pour les membres de Caldas. Mais tout de même, ils n'en espéraient pas moins que, ayant fait leur part, construit le nœud local, donné beaucoup de leur temps pour le faire fonctionner, établi des contacts, densifié le réseau, ils pourraient profiter du travail accompli pour avoir ne fut-ce que des informations en retour. Le réseau devrait pouvoir, leur semblait-il les aider concrètement, par exemple : en indiquant les démarches à suivre par les candidats boursiers, en facilitant l'obtention de carte de séjour, de logement, de stages, de financements, d'informations sur la littérature scientifique, d'aide à leur propres publications... Et là, il faut bien reconnaître l'absence de remontée.

Tous les nœuds n'ont pas connu au même point cette phase de désaffection. En Suisse, notamment, la plupart des chercheurs ont un poste stable, et même les étudiants boursiers bénéficient d'une aide du gouvernement suisse, non de Colciencias. Ni pour leur séjour ni pour leur retour, ils ne se sentent « pris à la gorge », et leur attente est donc beaucoup moins forte. Et rapidement se mirent en place des projets qui mobilisèrent ceux qui y étaient intéressés. Par contre, tous les autres cessèrent, très rapidement, de s'intéresser à des réunions où l'on ne parlait de rien qui les concernât. Un tel reflux fut parfois brutal. En France, les toutes premières réunions regroupaient environ 300 personnes : rapidement, ce chiffre est tombé à une petite centaine : « à quoi bon se dépenser, quels moyens avons-nous pour que ça marche, quel intérêt de continuer, puisque c'est à sens unique ? » Au Mexique, il fut décidé, dans la phase créative du début, de lancer un questionnaire pour connaître l'état des forces scientifiques colombiennes dans le pays : il reçut 21 réponses... qui furent perdues ! Il est vrai que les réunions ne comportaient pas d'objectif précis et que, finalement, les participants qui n'étaient pas engagés dans la recherche et venaient par simple patriotisme se lassèrent, et que ceux qui venaient en tant que professionnels ne voyaient plus ce que le réseau apportait ni à la science, ni -surtout- à eux-mêmes : l'espoir que le réseau pourrait servir à faciliter un retour au pays, à trouver du travail, etc., cet espoir là s'écroula rapidement, comme un rêve naïf.

Le nœud mexicain est parvenu à rétablir la situation, mais dans une certaine mesure seulement : une réunion régulière, trimestrielle, se tient désormais à l'ambassade, réunissant avec constance une dizaine de personnes, avec un ordre du jour concret, mais, comme en Suisse, ceux qui participent sont ceux qui ont un projet précis à développer. La Suisse n'est pas non plus parvenue à faire en sorte de retrouver une partie de ceux qui s'étaient mobilisés au départ (il n'y a pas de bulletin, pas de réunions à date fixe, pas de convocation systématique...). Mais là où le nombre de chercheurs Colombiens est suffisamment important pour être moins sensible à ce type d'effets, les choses ont repris un cours plus conforme à l'idée initiale de constitution des nœuds et, à l'attente crédule puis à la déception radicale a succédé une perception moins excessive de la réalité. D'autant que si, pour la grande majorité, être membre de Caldas n'apporte toujours pas, sauf de façon marginale, l'accès à un réseau scientifique, cela apporte l'accès à un réseau stratégique, qui facilite réellement la recherche de ressources, d'emploi, d'une place plus solide en Colombie, pour le jour du retour... Le reflux était sans doute conjoncturel, mais il pose la question des rapports entre Caldas et Colciencias.

Colciencias, vue depuis les nœuds

« Colciencias, c'est une avancée considérable, révolutionnaire par rapport à avant. Mais il y a la tête, qui prend des initiatives, qui bouge, qui comprend quelque chose à la recherche, à la science et aux pratiques scientifiques, et en dessous, il y a l'effroyable bureaucratie colombienne ». Cette analyse d'un des fondateurs et principaux responsables de la Caldas se retrouve -surtout, il faut bien le dire, sa partie négative !- dans un très grand nombre des interviews que nous avons menées. Elle s'étend d'ailleurs aux Universités colombiennes, incapables de s'unir, de s'entendre, de conjuguer leurs forces, chacun voulant dominer l'autre : « Avec la R-Caldas, il est plus facile de faire collaborer New-York, Paris, Londres et Genève que Bogota et Cali ! ». On lui reproche avant tout son silence, sa lourdeur, sa lenteur, bref : une communication déficiente ; on lui reproche à l'envi l'insuffisance du soutien financier, de l'aide, des moyens accordés, bref : une gestion comptable bureaucratique ; on lui reproche encore l'absence de clarification sur le rôle des nœuds et des coordinateurs, l'absence d'une vision internationale de la recherche («on nous envoie tous les documents en espagnol, je suis donc obligé de les faire traduire en anglais si je veux que mes partenaires en aient connaissance »), son incompréhension des logiques scientifiques («on refuse mon projet parce qu'il aurait déjà été réalisé, comme si tout ce qui se faisait sur un même champ, avec des méthodes et une problématique complètement differentes, s'équivalait ! »), bref : une vision administrative ; on lui reproche enfin de ne considérer les Colombiens de l'extérieur que comme des pièces sur l'échiquier d'Internet que l'on peut utiliser, de favoriser largement les projets en sciences dures, de ne pas afficher ses critères de sélection pour être plus libres de prendre seule ses décisions, bref : sinon une manipulation politicienne de la science, du moins une gestion politique.

Quand on connaît avec quels moyens et avec quelles forces humaines travaillaient ceux qui, à Colciencias, s'occupaient de faire marcher le réseau Caldas, avec quel dévouement ils se sont attelés à la tâche, on trouvera ces reproches bien injustes. Mais taire un malentendu n'est en rien aider à le dissiper. Bien entendu, on l'aura compris, c'est surtout au cours de la période de lancement et de consolidation du réseau que ces accusations ont fleuri : Colciencias, débordé par le succès de Caldas, a laissé filer le décalage entre l'espoir semé par son Directeur et des retombées concrètes, sans fixer de politique claire permettant de savoir à quoi réellement s'en tenir. Si les griefs ne sont pas oubliés, tant s'en faut, le jugement n'est plus aussi négatif. On reconnaît volontiers, désormais, que son soutien moral et financier a été, en fait, déterminant. Et puis, c'est quand même à l'initiative de Colciencias que l'on doit Caldas, et cette initiative a été extraordinairement bien appréciée, a énormément bénéficié à l'image de la science colombienne et de la Colombie. Mais c'est une arme à double tranchant, nous a-t-on expliqué, car en même temps, elle a mis a nu ses lourdeurs et ses défaillances (le problème des bourses qui n'arrivaient pas, par exemple, a occupé sur la messagerie, à une certaine époque, une place ostensible) : « c'est donc aussi un formidable moyen de pression, de démocratie ! ».

Et l'unanimité ne se fait pas sur les solutions à apporter au problème, preuve qu'elles ne s'imposent pas d'évidence. Soit c'est un renforcement de Colciencias que l'on espère («si seulement Colciencias avait plus de pouvoir, comme un vrai ministère, avec un vrai budget, une vraie capacité de décision...!») ; soit c'est une séparation franche entre Caldas et Colciencias qui est souhaitée, ce qui clarifierait la situation et interdirait de vaines attentes. Notons que les deux propositions ne sont d'ailleurs pas incompatibles entre elles, et que c'est, de toute façon, un renforcement de la communication avec la Colombie qui est exigé : « ce devrait être, pour Caldas, le nœud le plus important, et c'est, de loin, le moins efficace. On manque terriblement de relais, d'aiguilleurs, en Colombie, pour établir les liens pertinents ».

Deux conceptions de la science et du scientifique

Les explications du découragement relatif qui a frappé la plupart des nœuds, et de la remobilisation qui a suivi, de la défiance vis-à-vis de Colciencias, et du jugement plus nuancé qui lui a succédé, relèvent à nouveau, me semble-t-il, de deux domaines distincts dont l'un, comme pour notre proposition de typologie des nœuds, est contingent, l'autre, plus structurel. Pour notre typologie, la contingence était de l'ordre du spatial : on résidait, ou non, dans un pays à la communauté scientique restreinte ; ici, elle est de l'ordre du temporel : on est encore dans une phase où l'attente dépasse de loin toutes retombées concrètes, ou on l'a dépassée. Mais dans les deux cas, l'opposition structurelle relève de la vision que l'on a de la science, du rôle des chercheurs, et de leur relation avec la société civile : on est d'autant plus déçu que l'on est plus « science d'abord ».

On l'a vu courir tout au long de ce texte, sous forme d'une opposition entre « sciences dures » et « sciences humaines », opposition qui n'est que le signe le plus fréquent et le plus manifeste de cette autre rupture : celle qui sépare une vision « internaliste » de la science et une vision plus sensible à sa contextualisation sociale. La question est de savoir si la science ne se développe que par elle-même, d'elle même et, essentiellement, pour elle-même ? Si la société et la science sont liées, est-ce seulement que chacune offre à l'autre les moyens de son fonctionnement : sous forme de financement pour l'une, sous forme de résultats, de progrès techniques pour l'autre ? Ou les problèmes de recherche que l'on croit relever du seul questionnement scientifique ont-ils à voir avec les problèmes qu'affronte, sans qu'il y ait une réponse scientifique possible, la société ? En un mot, l'histoire des sciences est-elle une discipline spécifique, ou une branche particulière de l'histoire tout court ?

C'est à cette question que les nœuds répondent implicitement, lorsqu'ils se posent celle de savoir *qui* peut faire partie de Caldas. Et la plupart se la sont posée explicitement, à commencer par Colciencias, pour qui, au départ, le réseau devait bien être rigoureusement scientifique, et exclure même les étudiants. C'est à éliminer les candidats non reconnus comme des chercheurs que devait répondre le *curriculum vitae* que Colciencias demanda à tous ceux qui voulaient s'inscrire sur la R-Caldas. Le nœud italien, le suédois, au moins au début, furent sur les mêmes positions. Et si le nœud suisse, puis le nœud suédois, en un second temps, acceptent les étudiants, ils veulent limiter leur recrutement à des gens qui du moins ont à voir avec la science (fut-elle science sociale). Malgré les opinions de quelques irréductibles («il y a des étudiants qui entrent dans l'association en espérant obtenir quelque chose, mais le but de l'association n'est pas d'en obtenir quoi que ce soit ; les étudiants devraient d'abord finir leur thèse, et entrer ensuite dans l'association »), nulle part, désormais, les étudiants ne sont rejetés de Caldas.

Au problème des limites à fixer au groupe, d'autres n'ont répondu -du moins à notre connaissance- que de façon implicite, ou ont répondu dans les faits de façon différente que dans le discours, mais parfois en refermant plus encore le « groupe d'appartenance ». Si nulle part les sciences sociales ne sont officiellement présentées comme « pas assez scientifiques » pour en faire partie, pour autant le nœud belge, au début, ou le nœud suisse, toujours, ont tenu à l'écart ces dernières (et l'on a vu que Colciencias était soupçonnée d'en faire autant). En Belgique, dans un second temps, en Italie, en Grande-Bretagne, en Suède, dans le nœud californien, les sciences sociales sont bien présentes, mais ce n'est que dans les nœuds français, méxicains, et dans celui de Washington, qu'on inclut les personnes non scientifiques (mais simplement « intéressées » au développement de la science en Colombie. Il n'y a finalement qu'à New-York que l'ouverture est totale, que n'importe qui peut participer, du moment qu'il a envie, justement, de participer (au point que, selon ce que rapporte du moins une interview menée sur place, on ne compte qu'une demi-douzaine de personnes qui se sentent réellement concernées par la R-Caldas !).

Le nœud suisse a déjà été présenté comme l'idéal-type de la position fermée ; on verra à quel point celle-ci est ancrée dans l'inconscient des chercheurs avec l'aveu suivant : interrogeant sur la composition du nœud et questionnant plus avant sur l'absence des sciences sociales, il me fut répondu « oui, maintenant, on peut les faire revenir, puisque les projets fonctionnent » (sic !). Et la nature de l'opposition se lit aussi dans le fait que *tous* les chercheurs de sciences sociales qui se sont inscrits au début se sont retrouvés ensuite dans « Groupo Colombia », une association qui s'occupe de solidarité sociale et de droit de l'homme ; mais qu'un seul chercheur de science exacte, actif dans Caldas, se consacre également à cette organisation. Ce n'est donc pas un simple souci d'efficacité qui conduit à vouloir écarter toute question sociale (et, par extension, toute science sociale), mais bien un choix, qui fait préférer la science, seule, et fait délaisser les problèmes de société. Significatif encore cette réflexion, sur la rareté des réunions organisées par le nœud : « on en fait avec les boursiers pour se connaître, s'aider, mais soyons pragmatiques : les étudiants qui veulent rentrer, c'est pas ça l'important ! Maintenant, les projets sont bien lancés, il y a moins besoin de se réunir ».

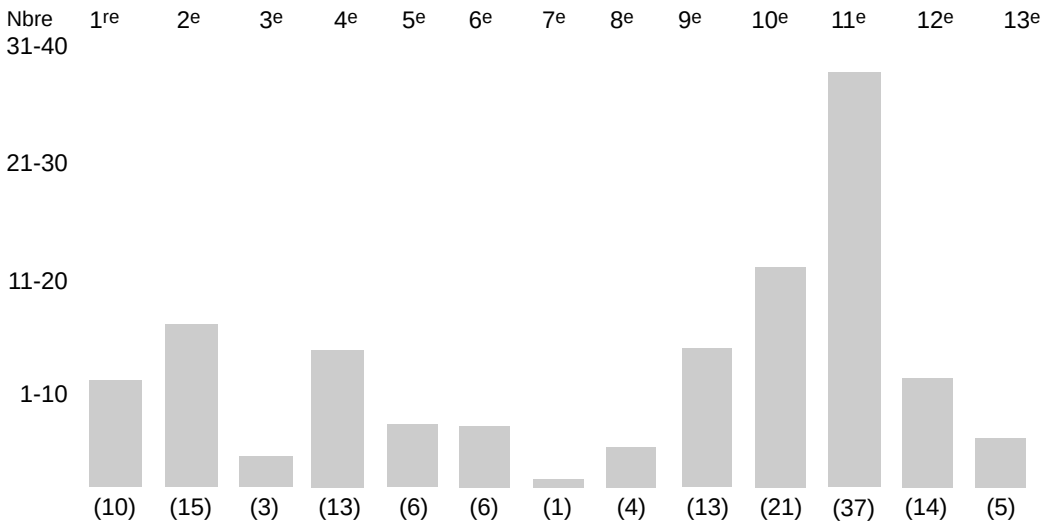
Le réseau des idées ou le réseau des hommes ?

Ce dernier propos d'un membre actif du nœud suisse est particulièrement significatif. Le modèle implicite, c'est celui où le nœud, finalement, ne sert qu'à mettre en place ce qui compte vraiment : le développement de l'échange scientifique. A la limite, on pourrait s'en passer, si le réseau électronique était déjà bien ancré dans les mœurs, si l'on pouvait se contenter de dialoguer sur l'E. mail. Cette position est d'ailleurs défendue par l'un des initiateurs de Caldas, l'un des responsables très proche de Clemente Forero, et par ailleurs l'un des tout premiers coordinateur de nœud. Il s'agit bien entendu de Carlos Moreno, chercheur en informatique et en robotique, expert reconnu, dont on connaît bien les positions, notamment grâce à la R-Caldas, où il les largement exposées. On peut presque parler d'une tendance Moreno, tant il est représentatif d'une ligne où Caldas serait avant tout un réseau informatique, exclusivement scientifique, destiné à la communication et au partage des connaissances, avec le strict minimum de structure administrative et gestionnaire, considérant l'extension prise par les nœuds comme une dérive dangereuse. Carlos Moreno se considère désormais comme membre de Caldas, mais d'aucun nœud. En dehors du cas individuel, s'agit-il là du futur possible, sinon probable ?

A cette question, on pourrait débattre de façon théorique, et tenter de réfuter une vision où la recherche n'aurait plus besoin d'un ancrage dans l'échange concret, physique, localisé, en contexte ; contester que l'échange des idées puisse ne pas dépendre du lieu d'où celles-ci sont émises, ne plus connaître aucune frontière. Mais ce n'est pas ici le lieu d'un tel débat. Mieux vaut voir comment, dans les différents nœud, concrètement, est pensé, et utilisé, l'outil de la R-Caldas, le versant informatique du réseau.

Cette analyse est évidemment complémentaire de celle qui vous a déjà été faite : elle repose essentiellement sur les membres de Caldas qui n'utilisent pas le courrier électronique. En effet, elle s'appuie sur les interviews des membres de différents nœuds : or, il semble que ce soit *une majorité d'entre eux* qui ne sont pas reliés à Internet (au Mexique, il semble qu'il n'y ait même pas de communication électronique du tout). Et parmi ceux qui sont connectés, nombre d'entre eux n'ont pas élargi le nombre de leurs interlocuteurs depuis qu'ils sont membres de Caldas. Même en Suisse, où ni le style de science valorisé, ni l'équipement informatique ne font défaut, la R-Caldas est finalement peu utilisée. Elle le fut beaucoup, au départ, elle a permis le maillage du nœud, le démarrage de projets, mais depuis, le rythme des échanges a sensiblement baissé, nous dit-on : « la R-Caldas devrait être autre chose qu'une simple *list-serv*., mais n'est que ça, et encore, pas effi-

cace ». Ailleurs, dans la plupart des cas, le courrier électronique sert à demander des informations (et encore, pas toujours d'ordre professionnel !), pas à dialoguer ; et les informations ne circulent guère que d'un individu à un autre, pas en chaîne. Il n'est pratiquement jamais utilisé ni pour communiquer avec d'autres nœud (sauf par les responsables, et par quelques individus particulièrement adepte de communication électronique), ni pour communiquer avec d'autres pays que celui de la résidence ou la Colombie. Un dépouillement de l'ensemble des messages passés au sein du réseau électronique PECX (le nœud de New-York), du 27 novembre 1994 au 8 mai 1995 est à cet égard bien illustratif. Sur un total de 255 messages, 148 (soit près de 60 %) sont émis par un membre de PECX à la liste électronique de PECX, les 107 autres provenant de l'extérieur et adressé à l'ensemble des nœuds (à savoir : 27 de la R-Caldas, 75 de Nodos/EUronodos, et 5 du coordinateur du nœud suédois). Quant aux messages internes, il n'y a guère que dans ce même nœud PECX qu'ils circulent sur réseau électronique, et leur densité est extrêmement variable :



Nombre de messages internes dans le réseau électronique PECX,
par quinzaine du 27 novembre 1994 au 28 mai 1995.

En fait, la période étudiée était particulièrement mal choisie, si du moins l'on voulait une image du nombre moyen de messages échangés. En effet, les deux premiers pics (deuxième et quatrième quinzaines), correspondent aux échanges de vœux de Noël et de nouvelle année, et le creux de la 7ème quinzaine, à des vacances universitaires. Quant au pic qui commence à la 9ème quinzaine, il correspond pour une large part à un échange de messages de réprobation ou de soutien, suite à une expression malheureuse (*politically uncorrect*) de la coordinatrice du nœud, qui finira par démissionner : si on dépouille ces messages en fonction de leur contenu, en effet, on en trouve 98 qui relèvent effectivement de l'échange ou de la demande d'information sur Caldas ou sur un sujet scientifique, mais dont 22 concernent directement l'affaire du message maladroit ; et 50 qui correspondent à des préoccupations d'ordre politique, culturel ou social (incluant les vœux).

En règle général et pour l'ensemble des nœuds, l'outil n'est donc guère utilisé. Par contre, il est pensé très positivement, et nul ne voudrait y renoncer. C'est grâce à lui que s'établissent quand même les contacts avec la Colombie et, dans certains cas (New-York), entre membres du nœud, entre les réunions. Mais le consensus est pratiquement unanime pour dire que l'échange électronique ne saurait que compléter l'échange verbal, face à face, pas le remplacer. L'effet réseau fait boule de neige, explique-t-on, mais ce qui compte, c'est la R-Caldas plus le nœud, « car les connaissances qu'on fait par relations communes sont plus vraies que celles faites seulement sur le réseau ». Un coordinateur nous confirme : « je transmets les informations à l'ensemble des coordinateurs, mais je ne reçois de retour que de ceux avec qui j'ai établi, auparavant, des liens personnels, que déjà j'ai rencontrés, physiquement ».

Un modèle qui ne s'incarne pas tel quel, un bilan pour autant largement positif

Le modèle rêvé par certains du « laboratoire virtuel, ou les chercheurs sont reliés entre eux, abolissant la distance » (Nihon Keizai Shimbun, 1995) ne trouvent donc pas vraiment sa réalisation dans le réseau Caldas. La structure des communications des chercheurs Colombiens expatriés ne ressemble pas, on l'a vu, à un filet de pêche dont le maillage engloberait le monde, mais a une étoile ayant la Colombie pour centre et un rayon pour chaque nœud. Ce modèle trouve-t-il d'ailleurs sa réalisation dans quelque forum que ce soit ? Sans entrer dans ce débat, qu'il me soit permis de citer les conclusions d'un jeune chercheur (Hert, 1995) qui me paraissent poser le même problème que celui évoqué au long de cette communication : « Les échanges électroniques prétendent arriver à un consensus à travers une participation collective, mais en fait, le courrier électronique est mobilisé comme outil de promotion individuelle (...). Grâce aux moyens techniques, chaque abonné a la même possibilité d'expression, mais le débat plonge les participants dans un contexte social, avec tout le cortège d'inégalités l'accompagnant (...). Cet écart entre la possibilité technique et l'usage social des outils souligne bien que la difficulté ne se trouve pas du côté de la technique, mais dans les rapports sociaux et humains ». Pour les mêmes raisons -un encadrement favorable, matériel, mais aussi humain, un réseau de relations personnelles, est une des conditions nécessaires d'une recherche productive- qu'il ne suffit pas de faire revenir les cerveaux pour résoudre le problème du brain drain, pour les mêmes raisons il ne *suffit pas* de faire revenir les idées. Ceux-ci et celles-là ne se déplacent pas comme des entités autonomes, mais ont besoin d'un enracinement favorable pour se développer.

Pour autant, et pour conclure, il nous semble incontestable qu'on peut déjà considérer que l'expérience est une réussite. Pour donner une image, il en va du décalage entre le modèle théorique qu'on se proposait de conduire et la réalité observée comme du décalage entre le nombre d'inscrits affichés par des différents nœuds et le nombre effectif de participants aux réunions ! Ce dernier, selon les nœuds, est de trois à dix fois moindre. En conclure à l'échec du projet serait absurde : l'important est qu'il y ait des réunions, régulières, avec un nombre à peu près constant, fidèle, de participants. Et tel est bien le cas, tournant d'ailleurs toujours autour d'une dizaine de personnes, pour les nœuds où le nombre d'inscrits est de quelque importance, comme s'il s'agissait là d'une limite maximale pour que des gens aient l'impression de réellement travailler ensemble.

Et justement, les membres actifs du réseau Caldas ont bien le sentiment de travailler ensemble, efficacement, et de faire œuvre utile : pour eux, plus ou moins directement ; pour la Colombie, toujours ; pour le développement de la science colombienne, souvent ; et pour le développement de la science, parfois.

Chaque nœud, en effet, développe des activités concrètes. Parmi ceux que nous avons étudiés, à l'exception de la Suisse et des plus petits nœuds nord-américains, tous diffusent régulièrement un bulletin d'information, portant essentiellement sur les actualités scientifiques développées, dans le cadre de Caldas ou non, en Colombie ou dans le pays de résidence. Et rendent compte des activités réalisées par le nœud, ou en projet : conférences, séminaires, colloques, tables rondes, cours d'utilisation de l'outil informatique, ateliers de traduction, réunion d'information spécifiques (à l'usage des étudiants boursiers, des nouveaux arrivants...) et, bien entendu, présentation et compte-rendu de l'état d'avancement des projets.

Ceux-ci sont la retombée la plus visible du réseau Caldas. Une opération comme Bio-2000 ne passe pas inaperçue ! On va vous en parler plus longuement, et je ne m'étendrai donc pas sur leur description. Mais leur place dans les nœuds est tout à fait centrale : plusieurs des coordi-

nateurs (Grande-Bretagne, Mexique, Suède, Suisse, Washington...) considèrent même que c'est le fondement même de leur action, que leur mission est de créer des liens pour que se développent des projets de recherche conjoints avec la Colombie (de servir d'interface, de mettre en place les réseaux, d'intéresser les institutions du pays de résidence) ; et que, ceux-ci établis, ils auront rempli l'essentiel de leur travail. Le montage de projets leur apparaît comme le critère d'évaluation, et la condition de leur survie, en tant qu'association : « un groupe, sans projet précis, meurt », nous disait l'un d'eux, et il pensait bien « projet » dans ce sens précis de programme de recherche scientifique associant leur pays de résidence et leur pays d'origine.

Et ceux qui sont pris dans ces programmes reconnaissent tous le rôle de Caldas dans sa réalisation, soit directement -sans Caldas, certains n'auraient tout simplement pas existé-, soit indirectement : « il aurait peut-être été monté quand même, c'est une initiative individuelle, mais ce n'est pas sûr : Caldas a donné l'impulsion, le courage ».

Pour tous ceux qui ont contribué à ce que de tels propos soient tenus, je pense qu'ils doivent retentir de façon gratifiante ; pour tous les chercheurs du Sud, qu'ils doivent sonner comme des paroles d'espoir.

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[1] De fait, on a pu récemment constater que les pays ayant connu des taux particulièrement élevés de « brain drain », sont également ceux qui ont expérimenté des développements scientifiques relativement plus rapides. Le rôle des chercheurs indiens expatriés dans le développement de la biologie cellulaire en Inde en est une illustration parmi d'autres. Des tentatives ont été également mises sur pied dans quelques pays du Sud pour organiser et re-connecter la communauté des chercheurs nationaux vivant à l'étranger avec la communauté scientifique nationale, autour d'activités scientifiques d'intérêt commun. C'est notamment le cas de la Corée du Sud, de Taiwan, de Singapour, d'Israël, de l'Inde et de la Chine pour n'en citer que quelques uns. La Chine Populaire, qui, jusqu'aux événements récents de la place de Tienanmen, ne considérait pas le brain drain comme un problème important, s'efforce aujourd'hui de mettre en place des stratégies pour faire rentrer ses chercheurs, plutôt qu'elle ne cherche à profiter structurellement de sa diaspora scientifique. Israël, plus proche du cas colombien puisqu'on y cherche également à organiser le retour des idées et non des cerveaux, joue également sur d'autres motivations que la seule appartenance à une communauté nationale. De nombreuses conférences ont aussi été organisées au cours des dernières années dans nombre de pays de l'Est (ex. Roumanie en 1994) mais aussi du Sud (ex. Maroc en 1993) dans le but de rassembler la diaspora scientifique nationale dispersée à travers le monde et de susciter des collaborations avec la communauté scientifique nationale. Un nombre important d'associations de chercheurs expatriés se sont également récemment développées à l'initiative de ces chercheurs. Un exemple particulièrement dynamique est celui de la 'Society of Chinese Bioscientists in America'(SCBA) dont le nombre de membres est passé de 200 en 1985 à 1500 en 1993. Des organisations non-gouvernementales s'investissent également dans ces efforts de mobilisation des chercheurs expatriés. C'est le cas de l'Académie des Sciences du Tiers Monde et de la Third World Foundation of North America. Cette dernière Fondation, hébergée par l'Université du Maryland aux Etats Unis, a entrepris de répertorier l'ensemble des chercheurs expatriés travaillant sur le territoire américain en commençant par les chercheurs originaires de l'Inde.

[2] Ce projet fait l'objet d'une convention avec l'Université Nationale de Colombie et est placé sous la double coordination de Jorge Charum, chercheur/professeur de cette université et de Jean-Baptiste Meyer, chercheur Orstom affecté à Bogota Il comprend en outre, en Colombie, José Granes, Alvaro Morales, Alvaro Montenegro, Luz Stella Parrado et Carlos Murcia ; au Mexique, Nora Narvaez-Berthelemot ; aux Etats-Unis, Jacques Gaillard ; Dora Bernal en Autriche ; et en France, Bernard Schlemmer (rejoint par Jacques Gaillard).

[3] Mais ce qui vient d'être écrit signifie que lorsque nous parlerons d'un nœud de « type suisse », celà ne signifie nullement qu'il y ait un modèle suisse de nœud Caldas, mais que le nœud suisse tel que nous l'avons étudié à un moment donné, nous parait constituer une sorte d'idéal-type.

[4] Le responsable du nœud, qui est lui même médecin, a cependant commencé à ouvrir le nœud en accueillant des chercheurs en sciences sociales ainsi qu'en sollicitant des compétences dans d'autres domaines (comme les sciences de l'environnement pour lequel la Suède a beaucoup d'expertises à offrir).

[5] Interview mené par J.B. Meyer.

Potentialities and Limitations of the Caldas Network of Colombian Researchers Abroad: Case Studies of Joint International Projects

José Granés
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The Caldas Network

The Caldas Network of Colombian researchers and professionals abroad is the expression of a new policy to take advantage, for the benefit of science and technology in Colombia, of the intellectual capacity of expatriate scientists and engineers.

Up to the end of the ‘80s the government policies to connect to the country the competence of the expatriate intellectuals were reduced to the establishment of a series of programs to encourage the return to Colombia of this expatriate capacity. Taken as a whole, it could be said that this policy failed. Notwithstanding the incentives, it was difficult for the institutions of the country to offer researchers with experience who were returning, conditions comparable to those that they had in their former countries of residence. The deepest felt difference was apparent as refers to the favorable conditions for the intellectual and scientific development of the people who returned to the country. Very frequently, Colombian institutions engaged in research and education of scientists and engineers could not offer an environment that would permit to disclose with force the competence of the scientists who returned. Many of them were faced with huge difficulties, for the lack of resources and experience in our institutions, to build the infrastructure necessary for the advance in their research fields, and at the same time their ties with the international scientific community became weaker. In view of this situation, many ended up returning to the country that had welcomed them. At the end their efforts did not have a repercussion, to the extent expected, on the advance of Colombian science.

At the beginning of the ‘90s, and within the framework of a government policy of support to science and technology in Colombia, a new idea takes form, much more flexible, to achieve the participation by “expatriate brains” to the intellectual and cultural development of the country. It is not longer a matter of offering incentives for the return of intellectuals -return that in some cases even proved to cause the opposite result- but of establishing and stimulating forms of relationships and institutional mechanisms that will permit expatriate intellectual to cooperate, in very diverse ways and from their countries of residence, in activities related to the development of science and development in the country. The idea becomes concrete in what has been called the Caldas Colombian Network of scientists and engineers abroad.

In a very flexible manner, the network promotes various forms of cooperation with research groups and with scientists who work in Colombia : project evaluation, search for information, rendering of various services, holding conferences, attendance to events, trainees in research

laboratories, preparation and development of joint projects. The latter form of cooperation is, naturally, the most elaborate ; it is the one that permits a more intensive transfer of knowledge and which may have, for that same reason, longer term repercussions in the development of Colombian science. The preparation and performance of joint projects between Colombian research groups and groups abroad permits, in addition, to establish stable ties at an international level and support the formation of scientific and technological thinking in Colombia.

This study will analyze the development reached up to the present time by two cooperative research projects, both conceived through the network. The first one of them, called BIO-2000 project, involves a cooperation between European and Latin American universities ; the second one is a bilateral project between the University of Valle and the CERMA in the area of automatics and robotics which had already concluded its first phase. The analysis will permit to illuminate aspects that have to do with the international scientific cooperation, with the operation of the network and with its potentialities and limitations.

The Bio-2000 Project

BIO-2000 is a multinational project, of a technological type, which involves at the present time research groups from four European universities and five from Latin America. Its main purpose is to apply instrumentation, originally developed for the detection of elementary particles, to the area of biomedical sciences.

Conception

The BIO-2000 is born from a dream. It is the dream, so many times repeated, of emigrated Colombian students and residents : to place in a transforming and efficient manner, at the service of the development of the country, the expertise acquired abroad. This time the dream is embraced by an actor who because of his experience and his position is in a condition particularly favorable to make it real. Fernando Rivera has participated in European organizations for the defense of human rights in Colombia ; he has been, from Switzerland, one of the most important creator of the Caldas Network and one of its most active promoters and at the present time is associated to the CERN, the European center for research in high energy physics.

The initial idea, discussed with other Colombian students at the beginning of 1994, is that of orienting the knowledge acquired in the universities and in the foreign centers towards potential demands by the country in the areas of technological application. There is, naturally, a philosophy implied in these considerations : in developing countries such as Colombia, the priority of research and of technological innovation must be on fields susceptible of an application with social incidence. A few months before, in May, 1993, a cooperation agreement had been signed between the CERN and the Colombian government, which facilitated the cooperation by the center, and probably also by other European institutions, in scientific projects of technological application in Colombia. After the signature of the agreement, high officers from the University of Valle (in Cali) visit the CERN. These trips facilitate later contacts with researchers from this university. The contacts show interest on the part of Univalle and possibly have induced to thinking about this university as a strong cooperator for the project.

Without having yet a specific thematic in mind, Fernando Rivera and Frank Block, another physicist connected to the CERN, start to promote the idea. They meet with Juan Antonio Rubio, coordinator of the CERN for Latin America, who recommends them to talk to professor Georges Charpak, Nobel Prize winner in physics in 1992. Charpak, who because of family ties is interested in Colombia, has worked in the application of detectors of elementary particles to biomedical sciences and has achieved in this field important technological developments,

some of them commercialized. Charpak recommends this field of work for the new project. It is an open field, which permits to connect, at different levels of complexity, expertise of various disciplines and which, according to the opinion by the Nobel prize winner, appears as a very promising field as refers to the development of new technologies that can be commercialized [1]. The conversations with Charpak permit a greater degree of definition on the subject of the possible project. It would consist, broadly, in working on applications to biomedical sciences of instrumentation developed for particle physics.

It was thought that one of the conditions to carry out the project was to have resources available in Colombia and eventually in Switzerland. For these purposes, Charpak recommends to talk with Rodolfo Llinas, physician and researcher who works in the United States, a recognized personality of the group of Colombian expatriates abroad and who has strong ties with the country and the government. Llinas gets enthusiastic with the project and expresses his willingness to support it in the National System of Science and Technology and in other entities of the Colombian government.

By this time, the project is but a general idea that has, however, the support and possible participation by a Nobel prize winner in physics. In Colombia nothing specific is known about the possible project and on its subject but the participation by a Nobel prize winner creates expectations in some sectors of the academy, the industry and the government through Colciencias. The initial promoters of the idea are pressed by increasing expectations which, to a large extent have escaped their control.

In order to answer these expectations, it was decided to organize a meeting in the University of Valle with the participation by specialists of various areas related to the theme of the project, connected to different institutions. The meeting, called “First BIO-2000 Workshop”, is held in Cali from June 21-24, 1994, organized by the University of Valle and BIOTEC and with the sponsorship by Colciencias, the University de Valle and the University of Siegen (Germany).

The meeting, which awakens a lot of interest among attendants, may be considered as the first firm step towards the realization of the idea. The workshop permitted to define better the thematic spectrum and in addition to secure contacts with various European and Latin American universities [2].

An introductory conference by Fernando Rivera and Frank Block permits to understand fairly well how the project was conceived at that time. Several aspects are worth emphasizing :

- The project is initially conceived as an “international cooperation between CERN and Univalle” [3] although the participation by other national and international institutions is not excluded -and it is even encouraged. The selection of Univalle is justified because of its great interest in the development of biotechnology and the creation, just for this purpose, of the BIOTEC corporation [4]. The participation by the CERN is justified for the degree of development reached in this international center in the design and development of particle detectors.
- Several stages in the project are conceived, centered around the CERN and Univalle : 1) participation by Colombian researchers in groups of the CERN ; 2) construction and testing of prototypes in the CERN ; 3) transfer of the prototypes to the laboratory of Univalle for research and development activities.

The meeting permits to see three possible work fields, which are related to each other but different :

- Development of technology for the operation of detectors, that is, design, construction and characterization of different types of detectors.
- Processing of images.
- Application of detectors to biological research. The applications may include molecular biology, radiotherapy, medical images, etc.

As it can be seen, in this first stage of the project many features are still not well defined. First, there is a wrong appreciation on the role to be played by some of the institutions in the project ; such is the case of BIOTEC. It is believed that this corporation, engaged in the development of biotechnology, may have a leading role. Very soon, the directors of BIOTEC themselves will realize that actually the project is more for physicists and engineers than for biologists. BIOTEC, after having played an important promoting role in the first phase, will disappear as actor of the project in the second phase. Likewise, other actors that were of great importance in this first phase, such as Charpak and Llinas, will later pass to a second level of importance.

Construction of agreements

Examining the situation of the project one year later, outstanding changes are observed with respect to the initial idea. Perhaps the most important of them is that the project is no longer thought of as a bilateral CERN-Univalle project, and has become a multilateral cooperation project between European and Latin American universities. The University of Valle and, in general, the Colombian part have lost their leading roles. Maybe this passing to a second level of importance by the Colombian counterpart with respect to the leading role of the initial stage, when the idea was above all to promote the project, is due to the non existence of consolidated research groups working in related areas. Notwithstanding that the project admits contributions with different degrees of complexity, the laboratories with accumulated work in the area take a greater initiative in this second stage.

As a instrument of coordination and joint work, the so called “BIO-2000 Network” is created, together with an electronic communication list. In May, 1995, the institutions involved in the project were UniValle, CIF, Federal University of Rio de Janeiro, University of Santiago de Compostela, College de France/Paris VI and the CERN [5]. The commitments are still weak and are not yet supported by definite responsibilities and by a clear work division.

During the year 1995 a particularly intensive activity is developed of coordination meetings and electronic communication which seek mainly to achieve exact definitions of the work fields of the institutions involved in BIO-2000, negotiations to define the participation by some institutions such as the University of Turin and of Genoa and the coordination of the presentation of a proposal to the Alpha program of the European Community [6].

In September, 1995 the National University and the Institute of Cancerology, the Universities of Torino, Coimbra, Cuzco, the Peruvian University Cayetano Heredia had joined the list. A work division by large research subjects was made, which includes the processing of medical images, instrumentation for biology and medicine, detectors, high resolution detectors and parallel computation. With the purpose of requesting funding -particularly to the Alpha program of the European Community- two large components of the BIO-2000 Program are defined : 1) Research and development in the field of biomedical applications, and 2) education and mobility.

BIO-2000 has refined its profile as a technological project on physics and engineering applied to biology and medicine.

It is possible to obtain a good perception of the current status of BIO-2000 by consulting the results of the coordination meeting of the nodes of the network held on April 17, 1996 in the CERN. All the coordinators of the European nodes attend this meeting, maybe for the first time : representatives from the universities of Coimbra, Genoa, Turin, Santiago de Compostela, from the CERN and also the coordinator of the network Bernard Marechal, from the Federal University of Rio de Janeiro [7].

During this meeting is expressed the concern for the achievement of a greater coherence in the work fields and for maintaining the identity of the network, “combining the different subprojects towards the objective of achieving a common research project” [8]. Although a common

and single project is not yet possible, given the diversity of experiences and work fields of the participant nodes, an identification of the two great subjects of interest that offer possibilities of articulation in the future is achieved from the detailed reports from each one of the nodes : 1) treatment of medical images which will join together in the North, Genoa and Santiago de Compostela and in the South, Bogota, Cuzco and Lima ; 2) development of gaseous detectors which will join together in the North, Coimbra, Turin and Santiago de Compostela and in the South, Rio de Janeiro and Cali. The countries of the North are willing to cooperate but without changing their lines of work. The countries of the South will have to make an effort to adapt around these lines, striving to work in the fields that are within their reach but with possibilities to contribute to the joint project. For Colombian universities, this implies efforts in training people in the fields defined and the establishment of laboratories [9]. The results can only be seen in the medium term.

In the meeting there was also a balance made of the assistance obtained form the Alpha program of the European Community which consisted mainly in economic support for the activities B.1 type in preparation to mobility. Notwithstanding the support still restricted, the BIO-2000 project -and this is the important part- already exists officially for the European Community. Some actors believe, however, that it is not convenient, as it has been done up to the present, to center all financing efforts in the Alpha program.

Project of Automatics Between University of Valle Automation Group and University Evry-Val-d'Essone (France)

This is a project in the field of automatics that fosters the creation of a pole of excellence for research, promotion and development of this discipline in Colombia. The project involves three areas : robotics, automation and industrial networks. In a more specific manner, in the area of robotics the work is centered on the conception, design and construction of a multi-purpose industrial robot. The automation part is in a final negotiation stage between several national and regional institutional agents [10]. In the area of industrial networks, a project has been approved by the National System of Science and Technology and currently an additional financing on the part of the industrial sector is being negotiated. We will examine with some detail the areas of robotics and automation.

Conception and development of the project

In order to understand the reason for the robotics project it is necessary to take into account that since 1983 a research group in automatics and robotics has been consolidating in the University of Valle with a strong emphasis on the training of human resources in this area, up to the present time unknown in the academic environments of the country. From its initiation, this group works in association with the unit of metallurgic research of the University of Valle and integrates in its research and development strategy an industrial company whose interest is placed in robotics applied to welding and in automation of metal-mechanical processes [11]. This group will be the main national actor in the joint project to be created later on.

In the year 1992, by invitation from Colciencias, Carlos Moreno, one of the founders of the French node of the Caldas network, comes to Colombia ; he has an important professional history developed mainly in the CERMA -center of studies and research in mechanics and automation of the University of Evry- to induce in the academic-industrial sector leading edge technological innovation processes in the areas of automatics and industrial networks. In the course of the two visits made, Carlos Moreno contacts the research groups already established in the University of Valle and very quickly the ideas that will lead to the cooperation agreements between the two entities are outlined.

In a first phase of the cooperation, which extends from 1993 to 1995, an industrial robot of the SCARA type is designed and constructed jointly, within the framework of a division of tasks ; this robot is located in the University of Valle and at this time is fulfilling technological appropriation purposes of all the elements that it is also used in training human resources in pre-graduate and post-graduate studies.

With the completion and installation of the robot in Cali, an “International Applied Seminar” in Robotics, Automation and Industrial Networks is held in October, 1995. The fulfillment of the purposes of the first phase permit the execution of a second agreement directed to the creation of the Industrial Automation Institute. This Institute has several fundamental agents articulated with each other : the University of Valle, the CERMA, the Industrial Development Fund (FDI) of Valle del Cauca and the companies of the sector.

Another multiple cooperation proposal, which also involves the relationship CERMA-UniValle, is currently in an advanced negotiation phase. It is an automation and robotics project for the construction of plastic injection metal molds. What results relevant in this project, at the same time that it increases the possibilities for transformation of an entire industrial sector, is that in the project are assembled financial agents of the technological sector such as COLCIENCIAS and the IFI in association ; Institutions for consulting and transfer of technology to the industry such as CERMA, SENA-ASTIN-Colombo-German Center of Plastics and the University of Valle and an important number of regional companies of the sector. This project is included within the framework of the projects that have been defined as strategic for the country by the National Planning Department.

In order to achieve the confluence of forces so diverse, the understanding and negotiation activity developed by an actor [12] particularly well located in those contexts and knowledgeable of the logic of the different sectors has been decisive.

A Comparative View of the Internal Logic of the Two Projects

The two projects that have been examined are performed according to different logic and dynamics which depend, among other things, on the objects of each project, on the circumstances of their conception and events and of the details of the individual actors and institutions involved. The interest of a comparative study, although brief, lies in showing some outstanding characteristics of different ways of possible cooperation that seek to make efficient contribution to the technological development of the country.

Both projects are oriented by the willingness to cooperate with Colombia in a sense of high level transfer of technology. In both cases, the most active creators are members of the group of expatriate scientists with wide knowledge of the subjects, capable of mobilizing the foreign institutions to which they belong, as well as other sectors of international importance. They are also very active agents of the Caldas network, imbued of the spirit of cooperation with the country.

The project of automatics demand a receiving group with industrial vocation and in addition with sufficient knowledge, experience and expertise in order to perform efficiently the transfer of technology. From the beginning the purposes, development phases and addressees of this project are perfectly well defined. On the other hand, the BIO-2000 project is conceived by actors of the Caldas Network abroad without having previously examined the possibilities of its development in Colombia. In fact, as shown by subsequent events, there were no research

groups in the country working directly in the subjects of the project. This implies the need to construct, on the run, a definition both of the object and of the work areas. The consequence is that the greatest levels of uncertainty favor reorientation of objectives and insertion of new actors from other countries that were not anticipated at the beginning and who assume leadership positions in the process.

Although the final destination of both projects is considered in terms of their incidence on a certain social or economic sector, the university, for various reasons, is considered as an important mediating agent. Both projects are constructed on a academic rationale that must be creatively contrasted with the logic of other social sectors of users (industry, health sector). In addition, in both projects the socialization of knowledge as well as the exchanges of researchers and students is strongly favored.

The logic of the development of both projects presents marked differences. The automation project evolves within strong institutional frameworks, through explicit and articulated commitments and on the basis of well defined actions and schedules. The institutional agreements guarantee a long term stability for the project. On the other hand, up to the present time, the BIO-2000 project is presented, notwithstanding the unification and coordination efforts, as a federation of relatively independent projects, without support from interinstitutional agreements, and based more on the commitment by research groups and by the actors who orient them, than on the commitment by the institutions to which they belong. Both favor the circulation by researchers and post-graduate students through the different groups.

In the automatics project, given the knowledge of the subject on the part of national actors, the negotiations and agreements were achieved very fast, respecting mutual convenience. The negotiations and agreements have been a lot more difficult in the case of the BIO-2000 project.

Between the two projects there are different kinds of logic in the transfer of technology to the final users. In the automatics project, the transfer from the industrial sector is direct because from the beginning the project translates the tendencies and needs for modernization of the industrial sectors that receive the technology. In addition, there are in the industrial sector, sufficient bases to carry out a creative appropriation of the technology in question. In BIO-2000, the receivers belong, in general, to a disciplinary field other than that of applied physics and for that same reason would not have a marked interest in getting involved in the details of research that leads to the development of the technology. Their interest lies only in the adequate and safe use of this technology. Here the users are not defined beforehand. Each research group must look for the methods of interaction and transfer most adequate for the environment in which the activity is performed. It should be mentioned that it is necessary to construct, for every particular environment, the social subject receiver of the technologies.

Conclusions

The two projects that we have examined in this study may be considered as paradigmatic examples of possible and efficient forms of cooperation between research groups in Colombia and agents of the Colombian group of expatriate researchers and scientists abroad. Notwithstanding the differences, in both cases actors resident abroad, imbued by the spirit of cooperation of the Caldas Network, place at the service of each project the network of relations that they themselves have constructed in their countries of residence. To this respect, regardless of the use given to the mechanisms established by the Caldas Network, such as the R-Caldas electronic mail list and the nodes structure, the two projects are an expression of the

new Colombian Brain Gain policy, which is summarized in the effort to recover the intellectual capability of the group of expatriate scientists abroad without attempting their return to the country. In both projects -and this may be a general characteristic- the first steps in the conception and development are taken using in a very intensive manner the mechanisms offered by the Caldas Network. However, once the projects reach a first consolidation stage, they become underground and invisible for the network. The relations continue only between the actors and the institutions involved. In other words, every project creates, at a certain time, its own autonomous network of relations.

The contrasting of the two projects that we have studied, reveals also in a very clear manner how the existence of a knowledge previously accumulated in research groups active in Colombia, facilitates the definition of the fields and of the concrete forms of cooperation with the actors of the groups of expatriate scientists abroad.

The study has shown how the Caldas Network can favor the efforts for the development of projects. It is important to bear in mind, however, that it is not per se a mechanism for the generation of projects but rather a social net in permanent reconstruction which may favor the appearance of very different possibilities of cooperation. Under certain circumstances and depending on the sense of opportunity and on the willingness by the actors, these possibilities can become a reality in concrete cooperation actions. For this reason, any perception that in a obstinate manner would wish to make of the network a simple mechanism useful for pre-established cooperation purposes could give the opposite result.

1 See Frank Block and Fernando Rivera, “The BIO-2000 Project” in Proceedings of the 1st Bio-2000 Workshop about instrumentation for Biomedical Sciences, University of Valle, Cali, Colombia, July 21-24, 1994. “Following his advice [of Charpak] we discovered the instrumentation for biomedical sciences to be a very open and promising field of research. Charpak, being pioneer in this domain, showed us various possible applications of techniques developed by physicists and also the interesting option of industrializing and commercializing some results of related research” p. 2.

2 The meeting had the participation by 52 people from 5 countries and connected to 19 institutions. Among the attendees are physicists, engineers, biologists, physicians.

3 Proceedings... *Op. Cit.* p. 2

4 See, Proceedings...*Op. Cit.* p. 2 : “Universidad del Valle gives high priority to biotechnology and has foreseen a whole funding program for its development. The foundation of the BIOTEC Corporation, a separate institute belonging to Univalle constitutes one step in this direction”.

5 Personal communication from Fernando Rivera.

6 See documents : a) “Preparatory and Coordinating Meetings at the BIO-2000 Network” and b) Copies of e-mail in the BIO-2000 Network.

7 See “Minutes of the BIO-2000 Meeting (CERN April 17, 1996)”. The participants are : Armando Policarpo and Rui Ferriera from the University of Coimbra in Portugal ; Sandro Squarcia from the University of Genova and Flabio Marchetto from the University of Turin in Italy ; Bernard Marechal from the Federal University of Rio de Janeiro in Brazil ; Alfredo Iglesias from the University Santiago de Compostela in Spain and Ettore Rosso, Eduardo Silva, Jose Lamas, Frank Block and Fernando Rivera for the CERN.

[8] *Ibid.*

[9] The University of Valle has initiated the training process, supporting the doctorate studies of one of its professors, connected to the project.

[10] Among these agents are included up to the present time, the University of Valle, SENA-ASTIN, COLCIENCIAS and a group of regional businessmen from Valle del Cauca of the plastic and matrix sectors.

[11] Since 1984 there is an agreement executed by the University and the company.

[12] His simultaneous participation in committees to conceive and execute policies such as the National Council of Technological and Industrial Innovation of the National System of Science and Technology, the Technical Committee ASTIN-SENA and the University of Valle, permitted him, at a particularly proper nick of time, extend the social base of the CERMA-UNIVALLE cooperation.

Las potencialidades y limitaciones de la Red Caldas de investigadores colombianos en el exterior

José Granés
Alvaro Morales
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La Red Caldas

La Red Caldas de investigadores y profesionales colombianos en el exterior es la expresión de una nueva política para aprovechar, en beneficio de la ciencia y la tecnología en Colombia, la capacidad intelectual de científicos e ingenieros expatriados.

Hasta finales de los años 80 las políticas del gobierno para vincular al país las competencias de los « cerebros fugados » se reducían al establecimiento de una serie de programas para incentivar el retorno a Colombia de esta capacidad expatriada. Apreciada en su conjunto, podría decirse que esta política fracasó. A pesar de los incentivos, resultaba difícil para las instituciones del país ofrecerle a los investigadores con experiencia que retornaban condiciones comparables a las que tenían en sus antiguos países de residencia. La diferencia más profundamente sentida se manifestaba en lo relacionado a las condiciones propicias para el desarrollo intelectual y científico de las personas que volvían al país. Con mucha frecuencia, las instituciones colombianas dedicadas a la investigación y a la formación de científicos e ingenieros no podían ofrecer un entorno que permitiera desplegar con fuerza las competencias de los hombres de ciencia que retornaban. Muchos de ellos se vieron enfrentados a enormes dificultades, por la falta de recursos y de experiencia en nuestras instituciones, para construir la infraestructura necesaria para el avance de sus campos de investigación, a la vez que sus nexos con la comunidad científica internacional se debilitaban. Ante esta situación, muchos terminaban por retornar a los países que los habían acogido. En definitiva, sus esfuerzos no repercutían, en la medida de lo que se había esperado, en el avance de la ciencia colombiana.

A comienzos de la década de los 90, y dentro del marco de una política gubernamental de apoyo a la ciencia y a la tecnología en Colombia, toma forma una nueva idea, mucho más flexible, para lograr la vinculación de los « cerebros expatriados » al desarrollo intelectual y cultural del país. Ya no se trata simplemente de ofrecer incentivos para el retorno de intelectuales -retorno que en algunos casos demostró ser incluso contraproducente- sino de establecer y estimular formas de relación y mecanismos institucionales que permitan a los intelectuales expatriados colaborar, *de manera muy diversa y desde sus países de residencia*, en actividades relacionadas con el desarrollo de la ciencia y la tecnología en el país. La idea se concreta en lo que se ha llamado la Red Caldas de científicos e ingenieros colombianos en el exterior.

De manera muy flexible, la red promueve diversas formas de cooperación con los grupos de investigación y con los hombres de ciencia que trabajan en Colombia : evaluación de proyectos, búsqueda de información, prestación de servicios diversos, realización de conferencias, asistencia a eventos, pasantías en laboratorios de investigación, elaboración y desarrollo de

proyectos conjuntos. Esta última forma de cooperación es desde luego la más elaborada ; es la que permite una transferencia de conocimientos más intensa y la que puede tener, por eso mismo, repercusiones de más largo plazo en el desarrollo de la ciencia colombiana. La elaboración y realización de proyectos conjuntos entre grupos de investigación colombianos y grupos en el exterior permite además establecer nexos estables a nivel internacional y apoyar la formación de escuelas de pensamiento científico y tecnológico en Colombia.

En este trabajo se analizará el desarrollo que han tenido hasta el presente dos proyectos de investigación cooperados, gestados ambos a través de la red. El primero de ellos, llamado proyecto BIO-2000, envuelve una cooperación entre universidades europeas y latinoamericanas ; el segundo es un proyecto bilateral entre la Universidad del Valle y el CERMA en el área de automática y robótica que ya ha terminado su primera fase. El análisis permitirá iluminar aspectos que tienen que ver con la cooperación científica internacional, con el funcionamiento de la red y con sus potencialidades y limitaciones.

El Proyecto BIO-2000

BIO-2000 es un proyecto multinacional, de índole tecnológica, que envuelve en este momento grupos de investigación de cuatro universidades europeas y de cinco latinoamericanas. Su propósito central es el de aplicar instrumentación, originalmente desarrollada para la detección de partículas elementales, al área de las ciencias biomédicas.

La gestación

BIO-2000 nace de un sueño. Es el sueño, tantas veces repetido, de estudiantes y residentes colombianos emigrados : poner, de manera transformadora y eficaz, al servicio del desarrollo del país las competencias adquiridas en el exterior. Esta vez el sueño es abrigado por un actor que por su experiencia y su posición se encuentra en condiciones particularmente favorables para hacerlo real. Fernando Rivera ha participado en organizaciones europeas por la defensa de los derechos humanos en Colombia ; ha sido, desde Suiza, uno de los gestores más importantes de la red Caldas y uno de sus animadores más activos y se encuentra, en ese momento, vinculado con el CERN, el centro europeo para la investigación en la física de altas energías.

La idea inicial, discutida con otros estudiantes colombianos a comienzos de 1994, es la de orientar los conocimientos adquiridos en las universidades y en los centros del exterior hacia potenciales demandas del país en áreas de aplicación tecnológica. Hay, desde luego, una filosofía implícita en estas consideraciones : en países en vía de desarrollo como Colombia, la prioridad de la investigación y de la innovación tecnológica debe recaer sobre campos susceptibles de una aplicación con incidencia social. Algunos meses antes, en mayo de 1993, se había firmado un convenio de cooperación entre el CERN y el gobierno colombiano que facilitaba la colaboración del centro, y probablemente también de otras instituciones europeas, en proyectos científicos y de aplicación tecnológica para Colombia. Después de la firma del convenio, altos funcionarios de la Universidad del Valle visitan el CERN. Estos viajes facilitan contactos posteriores con investigadores de esta universidad. Los contactos demuestran interés por parte de UniValle y posiblemente hayan inducido a pensar en esta universidad como un colaborador fuerte para el proyecto.

Sin tener aún una temática específica en mente, Fernando Rivera y Frank Block, otro físico vinculado al CERN, comienzan a impulsar la idea. Se reunen con Juan Antonio Rubio, coordinador del CERN para America Latina, quien les recomienda hablar con el profesor Georges Charpak, premio nobel de física en 1992. Charpak, quien en razón de nexos familiares se interesa por Colombia, ha trabajado en la aplicación de detectores de partículas elementales a las

ciencias biomédicas y ha logrado en este terreno desarrollos tecnológicos importantes, algunos de ellos comercializados. Charpak recomienda este campo de trabajo para el naciente proyecto. Se trata de un campo abierto, que permite vincular, a distintos niveles de complejidad, competencias de muy diversas disciplinas y que, de acuerdo con la opinión del premio nobel, aparece como un campo muy prometedor en cuanto al desarrollo de nuevas tecnologías comercializables [1]. Las conversaciones con Charpak permiten un grado mayor de definición sobre la temática del posible proyecto. Se trataría, a grandes rasgos, de trabajar en aplicaciones a las ciencias biomédicas de instrumentación desarrollada para la física de partículas.

Se pensó que una de las condiciones para adelantar el proyecto era la de disponer de recursos en Colombia y eventualmente en Suiza. Para estos efectos, Charpak recomienda hablar con Rodolfo Llinás, médico e investigador que trabaja en Estados Unidos, figura reconocida de la diáspora científica colombiana y poseedor de vínculos fuertes con el país y con el gobierno. Llinás se entusiasma con el proyecto y manifiesta su disposición de apoyarlo en el Sistema Nacional de Ciencia y Tecnología y en otros organismos del gobierno colombiano.

A estas alturas, el proyecto no es sino una idea general que cuenta, sin embargo, con el aval y la posible participación de un premio nobel de física. En Colombia no se conoce nada específico sobre el posible proyecto y sobre su temática pero el concurso de un premio nobel crea expectativas en algunos sectores de la academia, de la industria y del gobierno a través de Colciencias. Los promotores iniciales de la idea se encuentran presionados por expectativas crecientes que en gran medida han escapado a su control.

Para responder a estas expectativas se decide organizar un encuentro en la Universidad del Valle con la participación de especialistas de diversas áreas relacionadas con el tema del proyecto, vinculados a distintas instituciones. El encuentro, denominado « First BIO-2000 Workshop », se lleva a cabo en Cali entre los días 21 y 24 de Junio de 1994, organizado por la Universidad del Valle y BIOTEC y con el patrocinio de Colciencias, la Universidad del Valle y la Universidad de Siegen (Alemania).

El encuentro, que despierta mucho interés entre los asistentes, puede considerarse como el primer paso en firme hacia la concreción de la idea. El workshop permitió definir mejor el espectro temático y además afianzar contactos con diversas universidades europeas y latinoamericanas [2].

Una conferencia introductoria de Fernando Rivera y Frank Block permite entender bastante bien cómo se concebía el proyecto en ese momento. Varios aspectos merecen destacarse :

- El proyecto se piensa inicialmente como una « colaboración internacional entre el CERN y UniValle » [3] aunque no se excluye -incluso se estimula- la participación de otras instituciones, nacionales e internacionales. Se justifica la escogencia de Univalle por su gran interés en el desarrollo de la biotecnología y la creación, justamente con este propósito, de la corporación BIOTEC [4]. Se justifica la participaciópn del CERN por el grado de desarrollo alcanzado en este centro internacional en el diseño y desarrollo de detectores de partículas.
- Se conciben varias etapas para el proyecto, centradas alrededor del CERN y de Univalle : 1) participación de investigadores colombianos en grupos del CERN ; 2) construcción y puesta a prueba de prototipos en el CERN : 3) transferencia de los prototipos al laboratorio en la UniValle para actividades de investigación y desarrollo.

El encuentro permite ver tres posibles campos de trabajo, relacionados pero distintos :

- Desarrollo de tecnología para el funcionamiento de detectores, es decir, diseño, construcción y caracterización de distintos tipos de detectores
- Procesamiento de imágenes
- Aplicación de detectores a la investigación biológica. Las aplicaciones pueden incluir biología molecular, radioterapia, imágenes médicas etc.

Como puede verse, en esta primera etapa del proyecto muchos rasgos se encuentran aún mal definidos. En primer lugar, existe una apreciación equivocada sobre el papel que pueden jugar

algunas de las instituciones en el proyecto, como es el caso de BIOTEC. Se piensa que esta corporación, dedicada al desarrollo de la biotecnología, puede tener un papel protagónico. Muy pronto, las mismas directivas de BIOTEC se darán cuenta de que en realidad el proyecto es más para físicos e ingenieros que para biólogos. BIOTEC, después de haber cumplido un papel promotor importante en la primera fase, desaparecerá como actor del proyecto en la segunda fase. De la misma manera, otros actores que resultaron de gran importancia en esta primera fase, como Charpak y Llinás, pasarán a un segundo plano más adelante.

La construcción de los acuerdos

Examinando la situación del proyecto un año después, se aprecian cambios notables con relación a la idea que inicialmente se tenía. Tal vez el más importante de ellos es que el proyecto ha dejado de pensarse como un proyecto bilateral CERN-UniValle, para convertirse en un proyecto multilateral de cooperación entre universidades europeas y universidades latinoamericanas. La universidad del Valle y en general la parte colombiana ha perdido protagonismo. Posiblemente, este paso a un segundo plano de la contraparte colombiana con relación al protagonismo de la etapa inicial, en la que se trataba ante todo de promover el proyecto, se debe a la no existencia de grupos de investigación consolidados trabajando en áreas afines. A pesar de que el proyecto admite colaboraciones con muy distintos niveles de complejidad, los laboratorios con trabajo acumulado en el área toman una mayor iniciativa en esta segunda etapa.

Como un instrumento de coordinación y de trabajo conjunto se crea la llamada « Red BIO-2000 », junto con una lista de comunicación electrónica. En mayo de 1995 las instituciones involucradas en el proyecto eran UniValle, CIF, Universidad Federal de Rio de Janeiro, Universidad de Santiago de Compostela, College de France/Paris VI y el CERN [5]. Los compromisos son aún débiles y no están todavía respaldados por responsabilidades determinadas y por una división clara del trabajo.

Durante el año 1995 se desarrolla una actividad particularmente intensa de reuniones de coordinación y de comunicación electrónica que buscan esencialmente definiciones suficientemente precisas de los campos de trabajo de las instituciones involucradas en BIO-2000, negociaciones para definir la vinculación de algunas instituciones como las universidades de Turín y de Génova y la coordinación de la presentación de una propuesta al programa alfa de la Comunidad Europea [6].

En septiembre de 1995 se han unido a la lista la Universidad Nacional y el Instituto de Cancerología, la Universidad de Torino, la de Coimbra, la Universidad de Cusco, la Universidad Peruana Cayetano Heredia. Se ha hecho una división del trabajo por grandes temas de investigación que incluye procesamiento de imágenes médicas, instrumentación para biología y medicina, detectores, detectores de alta resolución y computación en paralelo. Con el propósito de solicitar financiación -en particular al programa Alfa de la Comunidad Europea- se definen las dos grandes componentes del Programa BIO-2000 : 1) investigación y desarrollo en el campo de las aplicaciones biomédicas y 2) educación y movilidad.

BIO-2000 ha afinado su perfil como un proyecto tecnológico de física e ingeniería aplicadas a la biología y a la medicina.

Es posible lograr una buena apreciación del estado actual de BIO-2000 consultando los resultados de la reunión de coordinación de los nodos de la red sostenida el 17 de abril de1996 en el CERN. Asisten a ella, tal vez por primera vez, todos los coordinadores de los nodos europeos : representantes de las universidades de Coimbra, de Génova, de Turín, de Santiago de Compostela, del CERN y también el coordinador de la red Bernard Marechal, de la Universidad Federal de Rio de Janeiro [7].

Se manifiesta en este encuentro la preocupación por lograr una mayor coherencia en los campos de trabajo y mantener la identidad de la red, « combinando los diferentes subproyectos

hacia el objetivo final de lograr un proyecto común de investigación » [8]. Aunque un proyecto común y único no es aún posible, dada la diversidad de experiencias y campos de trabajo de los nodos participantes, se llega, sin embargo, a partir de informes detallados de cada uno de los nodos, a una identificación de dos grandes temas de interés que ofrecen hacia el futuro posibilidades de articulación : 1) el tratamiento de imágenes médicas que reuniría en el norte a Génova y Santiago de Compostela y en el sur a Bogotá, Cusco y Lima ; 2) desarrollo de detectores gaseosos que reuniría en el norte a Coimbra, Turín y Santiago de Compostela y en el sur a Rio de Janeiro y a Cali. Los países del norte están bien dispuestos a cooperar pero sin cambiar sus líneas de trabajo. Los países del sur tendrán que hacer un esfuerzo de adaptación alrededor de estas líneas, procurando trabajar en campos que estén a su alcance pero con posibilidades de aportar al proyecto conjunto. Para las universidades colombianas participantes, esto implica esfuerzos de formación de personas en los campos definidos y el montaje de laboratorios [9]. Los resultados no podrán verse sino en el mediano plazo.

En la reunión se hizo también un balance de la ayuda obtenida del programa Alfa de la Comunidad Europea que consistió esencialmente en apoyo económico para las actividades de tipo B.1, preparatorias a la movilidad. A pesar del apoyo aún restringido, el proyecto BIO-2000 -y esto es lo importante- ya existe oficialmente para la Comunidad Europea. Algunos actores piensan, sin embargo, que no es conveniente, como se ha hecho hasta el momento, centrar todos los esfuerzos de financiación en el programa Alfa.

Proyecto de automática entre Universidad del Valle-Grupo de Automatización y la Universidad de Evry Val-d'Essone (Francia)

Este es un proyecto en el campo de la automática que promueve la creación de un polo de excelencia para la investigación, promoción y desarrollo de esta disciplina en Colombia. El proyecto comprende tres áreas : robótica, automatización y redes industriales. De manera más específica, en el área de la robótica el trabajo se centra en la concepción, el diseño y la construcción de un robot industrial de propósito múltiple. Este primer objetivo del proyecto ya se ha completado. La parte de automatización se encuentra en una fase final de negociación entre varios agentes institucionales nacionales y de orden regional [10]. En el área de redes industriales, ha sido aprobado un proyecto por el Sistema Nacional de Ciencia y Tecnología y se está negociando en este momento una financiación adicional por parte del sector industrial. Examinaremos con algún detalle las áreas de róbotica y automatización.

Gestación y desarrollo del proyecto

Para entender el surgimiento del proyecto de robótica es necesario tener en cuenta que desde 1983 se ha venido consolidando en la Universidad del Valle un grupo de investigación en automática y robótica con un énfasis fuerte en la formación de recurso humano en esta área, hasta ese momento desconocida en los medios académicos del país. Desde sus inicios, este grupo tabaja en asocio con la unidad de investigaciones metalúrgicas de la Universidad del Valle e integra en su estrategia de investigación y desarrollo una empresa industrial cuyos intereses están puestos en la robótica aplicada a la soldadura y en la automatización de procesos metalmecánicos [11]. Este grupo será el actor nacional principal en el proyecto conjunto que habrá de crearse más adelante.

En el año de 1992, por invitación de Colciencias, viene a Colombia Carlos Moreno, uno de los fundadores del nodo francés de la red Caldas, con una trayectoria profesional importante desarrollada principamente en el CERMA -centro de estudios y de investigaciones en mecánica y automatismos de la Universidad D'Evry- para inducir en el sector académico-industrial procesos de innovación tecnológica de punta en las áreas de automática y redes industriales. En el

curso de las dos visitas que realiza, Carlos Moreno toma contacto con los grupos de investigación ya constituídos en la Universidad del Valle y muy rápidamente se esbozan las ideas que conducirán a los convenios de cooperación entre las dos entidades.

En una primera fase de la cooperación, que se prolonga entre 1993 y 1995, se diseña y construye conjuntamente, en el marco de una división de las tareas, un robot industrial de tipo SCARA que se sitúa en la Universidad del Valle y cumple en este momento propósitos de apropiación tecnológica de todos los elementos constitutivos del mismo y de formación de recursos humanos en pre y postgrado.

Con la terminación e instalación del robot en Cali, se realiza un « Seminario Internacional Aplicado » en Robótica, Automatización y Redes Industriales, en Octubre de 1995. El cumplimiento de los propósitos de la primera fase permite suscribir un segundo convenio que apunta a la creación del Instituto de Automatización Industrial. Este Instituto tiene varios agentes fundamentales articulados entre sí : la Universidad del Valle, el CERMA, el Fondo de Desarrollo Industrial (FDI) del Valle del Cauca y empresas del sector.

Otra propuesta de cooperación múltiple, que involucra también la relación CERMA-UniValle, se encuentra en este momento en una fase avanzada de negociación. Se trata del proyecto de automatización y robotización para la construcción de moldes metálicos de inyección de plásticos. Lo que resulta relevante en este proyecto, al tiempo que aumenta las posibilidades de transformación de todo un sector industrial, es que en él confluyen agentes financieros del sector tecnológico como COLCIENCIAS y el IFI en asociación ; instituciones para la asesoría y la transferencia de tecnología a la industria como son el CERMA, el SENA-ASTIN-Centro Colombo Alemán del Plástico y la Universidad del Valle y un número importante de empresas regionales del sector. Este proyecto se inscribe en el marco de los proyectos que han sido definidos como estratégicos para el país por el Departamento Nacional de Planeación (DNP).

Para lograr la confluencia de tan diversas fuerzas fue de la mayor importancia la actividad de concertación y de negociación de un actor [12] particularmente bien situado en esos contextos y conocedor de las lógicas de los diferentes sectores.

Una mirada comparativa a la lógica interna de los dos proyectos

Los dos proyectos que se han examinado se desenvuelven según lógicas y dinámicas diferentes que dependen, entre otras cosas, de los objetos de cada proyecto, de las circunstancias de su gestación y de su devenir y de las particularidades de los actores individuales e institucionales involucrados. El interés de un estudio comparativo, así sea somero, reside en mostrar algunas características sobresalientes dos vías distintas y posibles de colaboración que buscan hacer aportes eficaces al desarrollo tecnológico del pais.

Ambos proyectos se orientan por la voluntad de cooperación con Colombia en un sentido de transferencia de tecnología de alto nivel. En ambos casos, los gestores más activos son miembros de la diáspora científica con gran solvencia en sus conocimientos temáticos, capaces de movilizar a las instituciones extranjeras a las cuales pertenecen, así como a otros actores de importancia internacional. Son además agentes muy activos de la red Caldas, imbuídos del espíritu de cooperación con el país.

El proyecto de automática exige un grupo receptor con vocación industrial y además con conocimientos, experiencia y destrezas suficientes para que se pueda realizar eficazmente la trans-

ferencia tecnológica. Desde un comienzo los propósitos, las fases de desarrollo y los destinatarios de este proyecto están perfectamente bien definidos. En cambio, el proyecto BIO-2000 es concebido por actores de la Red Caldas en el extranjero sin que se hubieran previamente auscultado las posibilidades de su desarrollo en Colombia. De hecho, como lo demostraron los acontecimientos posteriores, no existían en el país grupos de investigación trabajando directamente en las temáticas del proyecto. Esto implica la necesidad de construir, sobre la marcha, una definición tanto del objeto como de las áreas de trabajo. La consecuencia es que los mayores niveles de incertidumbre favorecen reorientaciones de los objetivos e inserción de nuevos actores de otros países que no estaban previstos en un comienzo y que en el proceso toman una posición de liderazgo.

Aunque el destino final de ambos proyectos se piensa en términos de su incidencia sobre un determinado sector social o económico, la universidad, por varias razones, es considerada como un agente mediador importante. Ambos proyectos se construyen sobre una racionalidad académica que debe contrastarse creativamente con las lógicas de otros sectores sociales de usuarios (industria, sector de la salud). Además, en ambos proyectos se favorece fuertemente la socialización del conocimiento a partir de intercambios de investigadores y estudiantes.

La lógica del desarrollo de ambos proyectos presenta marcadas diferencias. El proyecto de automatización se desenvuelve dentro de marcos fuertemente institucionales, a través de compromisos explícitos y articulados y sobre la base de acciones y cronogramas bien definidos. Los acuerdos institucionales garantizan una estabilidad de largo plazo para el proyecto. En cambio, hasta el momento, el proyecto BIO-2000 se presenta, a pesar de los esfuerzos de unificación y coordinación, como una federación de proyectos relativamente independientes, sin respaldo de convenios interinstitucionales, basado más en los compromiso de los grupos de investigación y de los actores que los orientan que en el de las instituciones a las que pertenecen. Ambos favorecen la circulación de investigadores y estudiantes de postgrado a través de los diferentes grupos.

En el proyecto de automática, dado el conocimiento de la temática por parte de los actores nacionales, las negociaciones y los acuerdos se pudieron lograr muy rápidamente, respetando la conveniencia mutua. Las negociaciones y los acuerdos han sido mucho más difíciles en el caso del proyecto Bio-2000.

Entre los dos proyectos existen lógicas distintas en la transferencia tecnológica a los usuarios finales. En el de automática, la transferencia al sector industrial es directa porque desde el comienzo el proyecto traduce las tendencias y las necesidades de modernización de los sectores industriales receptores de la tecnología. Además existen en este sector de la industria, las bases suficientes para adelantar una apropiación creativa de la tecnología en cuestión. En BIO-2000, los receptores pertenecen en general a un campo disciplinar distinto al de la física aplicada y por esa misma razón no tendrían un marcado interés en involucrarse en los detalles de la investigación que conduce al desarrollo de la tecnología. Su interés reside solamente en el uso adecuado y seguro de la misma. Aquí los usuarios no están definidos de antemano. Cada grupo de investigación debe buscar las formas de interacción y de transferencia más adecuadas al entorno en que se desenvuelve su actividad. Vale decir que es necesario construir, para cada entoro particular, el sujeto social receptor de las tecnologías.

Conclusiones

Los dos proyectos que hemos examinado en este trabajo pueden ser considerados como ejemplos paradigmáticos de formas posibles y eficaces de colaboración entre grupos de investigación en Colombia y agentes de la diáspora de investigadores colombianos en el exterior. A pesar de las diferencias, en ambos casos actores residentes en el exterior, imbuídos por el espí-

ritu de cooperación de la Red Caldas, ponen al servicio de cada proyecto la red de relaciones que ellos mismos han construído en sus países de residencia. En este sentido, independientemente del uso que se haya hecho de los mecanismos establecidos por la Red Caldas, como son la lista de correo electrónico R-Caldas y la estructura de nodos, los dos proyectos son una expresión de la nueva política colombiana de Brain Gain, que se resume en el intento de recuperar la capacidad intelectual de la diáspora expatriada sin pretender su retorno al país. En ambos proyectos -y esta puede ser una característica general-, los primeros pasos en la gestación y desarrollo se dan utilizando de manera bastante intensiva los mecanismos que ofrece la Red Caldas. Sin embargo, una vez los proyectos llegan a una primera etapa de consolidación devienen subterráneos e invisibles para la red. Las relaciones se continúan solamente entre los actores y las instituciones involucradas. En otras palabras, cada proyecto crea, en un determinado momento, su propia red de relaciones autónoma.

La contrastación de los dos proyectos que hemos estudiado revela también de manera muy clara cómo la existencia de un conocimiento previamente acumulado en grupos de investigación activos en Colombia facilita la definición de los campos y de las formas concretas de cooperación con los actores de la diáspora científica.

El estudio ha mostrado cómo la Red Caldas puede fertilizar esfuerzos para el desarrollo de proyectos. Es importante tener en cuenta, sin embargo, que ella no es per se un mecanismo para la generación de proyectos sino más bien un tejido social en permanente reconstrucción que puede favorecer el surgimiento de posibilidades muy diversas de cooperación. En determinadas circunstancias y dependiendo del sentido de oportunidad y de la voluntad de los actores, estas posibilidades pueden critalizar en acciones concretas de colaboración. Por esta razón, cualquier percepción que de manera voluntarista quisiera hacer de la red un simple mecanismo útil para finalidades pre-establecidas de cooperación podría resultar contraproducente.

[1] Véase Frank Block y Fernando Rivera, « The BIO-2000 Project » en Proceedings of the 1st Bio-2000 Workshop about Instrumentation for Biomedical Sciences, Universidad del Valle, Cali, Colombia, 21-24 July 1994. « Following his advice [of Charpak| we discovered the instrumentation for biomedical sciences to be a very open and promising field of research. Charpak, being pioneer in this domain, showed us various possible applications of techniques developed by physicists and also the interesting option of industrializing and commercializing some results of related research » p. 2.

[2] El encuentro contó con la participación de 52 personas de 5 países y vinculadas a 19 institutos. Entre los asistentes figuran físicos, ingenieros, biólogos, médicos.

[3] Proceedings.... *Op. Cit.* p. 2

[4] Véase, Proceedings.... *Op. Cit.* p. 2 : « Universidad del Valle gives high priority to biotechnology and has forseen a whole funding program for its development. The foundation of the BIOTEC Corporation, a separate institute belonging to UniValle constitutes one step in this direction. »

[5] Comunicación personal de Fernando Rivera.

[6] Véanse los documentos : a) « Preparatory and Coordinating Meetings af the BIO-2000 Network » y b) copias de e-mail en la red BIO-2000.

[7] Ver « Minutes of the BIO-2000 Meeting (CERN April 17th 96) ». Los participantes son : Armando Policarpo y Rui Ferreira de la Universidad de Coimbra en Portugal ; Sandro Squarcia de la Universidad de Génova y Flavio Marchetto de la Universidad de Turín en Italia ; Bernard Marechal de la Universidad Federal de Rio de Janeiro en Brasil ; Alfredo Iglesias de la Universidad Santiago de Compostela en España y Ettore Rosso, Eduardo Silva, José Lamas, Frank Block y Fernando Rivera por el CERN.

[8] *Ibid*.

[9] La Universidad del Valle ha iniciado el proceso de formación, apoyando los estudios doctorales de uno de sus profesores, vinculado al proyecto.

[10] Entre estos agentes se encuentran hasta el momento, la Universidad del Valle, el SENA-ASTIN, COLCIENCIAS y un grupo de empresarios regionales del Valle del Cauca del sector de plástico y matricería.

[11] Desde 1984 existe un convenio suscrito por la Universidad y la empresa.

[12] Su vinculación simultánea a comités de instancias gestoras y ejecutoras de políticas como son Consejo Nacional de Innovación Tecnológica e Industrial del Sistema Nacional de Ciencia y Tecnología, el Comité Técnico ASTIN-SENA y la Universidad del Valle, le permitieron, en un momento coyuntural particularmente apropiado, ampliar la base social de la colaboración CERMA-UNIVALLE.

From Migration to Creativity in the Caldas Network: Psychoanalytical Approximations

Beatriz Mirámon Archila

A Peruvian legend tells that " from the cavity of the earth, the cave of the Pacaritambo (Dwelling of Dawn) the four Ayar brothers and their respective wives came out, equipped both in ornamental and in utility terms and started a slow walk through punas and mountain streams to find an appropriate place where to settle. Sisters and brothers were staying on the road transforming into sacred rocks or graves, while Ayar Manco and Mama Ocilo his wife, continue their pilgrimage extremely concerned for finding good lands for cropping.

Manco Capac owned two magic wands, one of which, when driven into the ground would indicate the place where they should settle down. He threw two gold canes, one fell in Colcabamba but the hard ground did not permit it to get in. The second was thrown in a land called Guaynaypata, where it penetrated softly. This place was later called Cuzco, which according to the language of that time meant to occupy a space. Upon arrival by Manco Capac and his people to Cuzco, the territory was densely inhabited, but its inhabitants made a place for the just arrived " (Rorstorowsky, 1988).

This myth of the Ayar brothers was a cultural creation by the Incas. Through words they attempted to show the historic references or main ways of thinking of history and society. The myth describes the archaic wishes, fears and hopes. Myths because of their picture quality, allow us to understand the difficulties and vicissitudes suffered by human beings, give us an account of the oral tradition. They open for us a space to think and to be able to tolerate pain, due to the renouncement to omnipotence which knowledge implies.

Migration is an experience that is present in the history of humanity through primary myths such as Eden, Babel, Oedipus. Maybe it would be convenient to remember two massive migratory currents and their consequences for humanity : the nomads tribes of Europe and Central Asia towards the West, which coincide with the fall of the Roman Empire ; the migration from Europe and North of Africa towards America with Colon.

The purpose of this paper is to study the vicissitudes suffered by every person who makes a migration, from a psychoanalytical point of view, that is, the emotions, anxieties and unconscious defenses that accompany the process. It investigates also the creativity and refers it to the migration process, because of the trends occurring during this event and may permit their development and even the emergence of creative acts of which the subject did not have any notion. I intend to refer this phenomenon to the Caldas Network, which with a wide instrumentation is a relevant area, while it has the privilege of being made up by a group of scientists, represents a field that because of its characteristics permits the observation of the creative act. This human group has the living experience of a migration. The Caldas Network gives to its members an identity of country, defines them as Colombian scientists abroad, this is one of the elements that permits the migrant a productive preparation of said process, which will be transformed into a personal and national benefit.

Migration

Psychoanalysts have been engaged for a long time on the subject of migration. Freud the initiator of the psychoanalysis went through that experience being a child (from his native town to Vienna) and at the end of his life he had to emigrate to London ; the pioneers in psychoanalysis were migrants since the psychoanalysis developed in Austria, Germany and Hungary before the Second World War. Because of historic situations, most of these pioneers had to live the migratory experience.

In private consultation the difficulties with respect to migration are evident in countries with a migrant population such as Argentina, where the state university in Buenos Aires has a " Center for Attention to the Migrate Student " which is an instrumentality of the School of Psychology, to assist young people who come to the capital to study (Bazan,1996). In Spain, the government has an institution for " returned migrants " engaged in the rescue of the Spanish language and in avoiding that the language of the country where the migration was made would be lost, thus seeking to rescue the importance of enriching the cultural resources proper of these processes. Israel has institutions specialized in taking care of the migrant as soon as he arrives, in order to provide support to foreign migrants who enter the country. Just to mention a few cases.

Psychoanalytical events have been organized in order to think about migration. One of them is the "Panel of pioneer psychoanalysts on the migratory experience ", held in the decade of the 70s in Philadelphia, with the participation by many psychoanalysts of European origin who arrived to the United States around the 30s-40s. Another event was the " Meeting of Psychologists and Psychoanalysts of Hungarian origin ", held in Budapest in 1994.

Doctor Angel Garma, founding member of the Argentinean Psychoanalytical Association, migrated from Spain to Berlin to obtain his education, then he was in Paris and went to Buenos Aires in order to form the Argentinean Psychoanalytical Association together with other Europeans and Argentineans educated abroad. The Colombian Psychoanalysis Society was originally established by psychoanalysts educated abroad who returned to Colombia.

The subject has so much importance, that in Argentina it is disclosed as prevention in mental health. For example, work is done on moving from one house to another, preparing the children for the mover in a similar manner as it is done for surgeries and naturally to make migratory processes.

Marta Békei, Hungarian migrant, introducer of the Psychosomatic Medicine in Argentina defines migration "...as a complex process which forces the individual to face a series of conflicts on the proper solution of which depends his success " (Békei, 1994). She calls migration as the moving of people from one country to another, whether voluntary or forced, temporary or permanent. These differences gave distinctive characteristics to the migratory process.

The experience is not given only by the transfer, but also by the process previous to separation and the ulterior process, the adaptation. It is a situation which is always painful, centered in the mourning that has to be addressed. Its successful preparation may strengthen the ego or to the contrary to give into the trauma (Békei 1994, Miramón y Barna, 1990).

The " ego " has to withstand intensive anguishes, to defend against the persecution and depressive anxieties. Under pathological conditions also of confusional anxieties that arise for lack of discrimination between the experiences of the country of birth and those of the adopted country (Miramón, 1992).

Contradictory feelings create tension and may cause conflicts that impose the work of undertaking mourning. The pain for the separation creates strong feelings of guilt that activate primitive defenses, producing symptoms in many cases (Miramón y Barna, 1990). The emotional work will be centered thus in the undertaking of the mourning and in the attempt to maintain the personal identity, threatened during the process of change.

One's own identity is given by the sensation of continue being oneself, is the result of the internalization of the experiences of the internal world and the belonging to a group or society, given in the outside world. The everyday, habitual events are elements closely connected to identity, the oneself. The subject " is ", lives " in ", works " in ", etc. With migration the world of the subject suffers a change and it is necessary to create other routines, habitual or everyday activities.

The phenomenon has been investigated from various angles, one is the language and the dreams. The dreams are characterized as traumatic, one dreams repeatedly with the trip, for example. This dream permits in its repeat the working of the situation of crisis. It is frequent that there may be periods of insomnia, with the consequent upsets in the everyday life which this symptom originates (Békei 1994).

Authors such as Chomsky and Lacan permit us to approximate to the importance of language and its vicissitudes, a process that the migrant faces, being forced to learn a new language or the idioms proper of each country even though the same language is spoken.

Chomsky points out that language is not a " mechanical " form imposed from outside to the subject but an innate germ that discloses towards the interior and acquires development of its peculiarities. This author states that language makes it possible to establish an order in the world : it serves as an organ of thought, of consciousness and of reflection, giving to the mind and the spirit an autonomy on the events lived (Chomsky, 1965).

Lacan conceptualizes language as preexisting to the subject, making an important distinction between significant and significate, these two relations are not overlapped between themselves. Lacan defines significant as the set of material elements of the language, connected through a structure ; it is the material support of the speech. Significant is a synchronous structure of the language material. The significate is the diachronic set of speeches. The significant has autonomy with respect to the significate (Lacan, 1953).

From this perspective, it is clear that in the migration process a confusion between significant and significate, with all the difficulties brought in the thinking process. The undertaking of the conflict may occur with pathology or without it. The pathological solution may be placed at the service of adaptation or it may prevent that it will occur and take the emigration process to failure. Migration is always a painful and traumatic experience. The intensity of the trauma depends to a large extent on the external and internal conditions, but the internal ones are those that control the way to solve the resulting conflict. The term trauma that I used is wider than the one initially used by Freud in the Etiology of the Neurosis for the past traumatic experiences, occurred generally in the infancy and for which he advised us as specific technique the catharsis (Freud,1987). The trauma to which I am referring is in the category of the so called " accumulative, silent or stress traumatism " (Moses 1978). With reactions not always noisy and apparent, but with deep and lasting effects (Moses, 1978).

Grinberg describes it as follows : " Migration is not an isolated traumatic experience which is stated at the time of the departure-separation from the place of origin, or in the arrival to the new place. It includes a constellation of determinant factors of anxiety and pain that may or may not have a clinical manifestation " (Miramón y Barna, 1990).

**Mental* (panic, states of confusion, insomnia, rage, nightmares, terrors, persecution deliria)

**Corporal* (heart beats, cardiac diseases, allergies, ulcers, cancer)

**Outside* WDHLD (accidents, difficulties with the spouse or family, labor and social conflicts).

The feeling of " helplessness " is the feeling that characterizes with greater force the migratory experience. And it is against this feeling that it is necessary to instrument, to think, to prepare, the adequate " continents " so that the process will be successful. In my understanding it is one of the angles where the Caldas Network " contains " the migrant Colombian scientist abroad. Migrations can be considered as situations of crisis. Kaes says that every crisis implies an idea

of " rupture ", separation or extirpation (Kaës et al., 1979). The normal development of the individual brings with it a series of crisis, the crisis of birth, the crisis of adolescence, the middle age of life. Migration is a contingency of life, potentially traumatic, characterized by partial traumatic events and at the same time configures a situation of crisis. The crises are periods of transition that represent for the individual both an occasion for growth, and a danger for the increase in vulnerability and therefore a possible mental disorganization.

Menges gives a criterion of " emigrability " attempting to determine the specific characteristics of the people and their potential conditions to migrate. He states indications and contraindications with respect to the process, referred to the capacity or lack of it, to overcome nostalgia (Menges, 1952 ; Garza y Guerrero, 1974 ; Dellarossa, 1978). Migration exposes the subject to go through states of disorganization, that are going to demand a later reorganization. But this is not always achieved.

The migrant needs a " potential space " to be able to make a transit to his new external World. In my understanding the Caldas Network facilitates to its members the generation of this space, helping to find it, to manage it and to develop it. The Caldas Network acts, in the manner of the " transitional objects " described by Winnicott (Winnicott, l976), which have the characteristic of permitting the transition, that is the passage, of the binomial mother-baby (Caldas Network - member) towards the external world (country to which the subject migrates).

It may also be understood from the model of Etiology, where the idea of migration that we are stating approximates to the "imprinting". Which explains the tendency of every newborn to get close to another living being, in order that at a potential level the latter may provide him contact and protection. The greater or lesser seriousness of the upsets caused by migration will also depend to a good extent of the age, characteristics of the group accompanying the migration.

The return should not be disregarded. The authors consider it as another migration with some characteristics proper to it, they say that whoever has migrated once will became in a certain way a foreigner for life. The person who returns to his country of origin will not belong to the country in the same way in which he left, he is no longer the same and the place will not be so either. A road has been reconstructed in several times, the subject that left will not be the same upon returning and when he returns will be perceived by the local people as a foreigner. Also to this respect as migrations may be considered the relocations made within the same country to very different regions. This is called "interior migration" (Miramón y Barna, 1990).

To work in the new country is a fact that favors the process. The work is an organizing and stabilizing factor of the psychic life, reaffirms self-esteem and allows to reassume one of the functions of adulthood after the regressive period of the arrival of the migrant. The process of elaboration is the result between progression and regression (Miramón,1992 ; Miramón y Barna, 1990).

To conclude this segment on migration, it is convenient to summarize the stages of the migratory process :

1) Feeling of pain for what is lost or left, fear of the unknown, feelings of abandonment, loneliness and needs. The anxieties invade the ego and produce a true disorganization. This state may be substituted by a maniac situation in which the difficulties of the change are minimized or its advantages are magnified.
2) After a variable period the migrant starts to feel nostalgia and pain for the world lost, recognizes his feelings and starts to incorporate progressively the elements of the new culture.
3) He recovers the pleasure of thinking, wishing and the capacity of making projects for the future. This level of the process facilitates the integration of the native culture with the new culture without having to renounce to any of them.

Creativity

We know of the difficulties that for some scientists means the possibility of including psychoanalysis among the sciences. Still now very close to the Twenty-first Century, the positivistic theories are strongly maintained, without accepting new points of view, subjective, which already at the beginning of the Twentieth Century were posed by physicists such as : Einstein with his " Theory of the Relativity ", Heisenberg with the " Equations of Uncertainty " and Born with his " Methodological indeterministic Model ".

This situation is not new, in fact Kuhn alerts about the difficulty of the change to new paradigms, unacceptable for scientists (Kuhn, 1992). The difficulties to extend the parameters towards a new modern concept of science, where the scientific does not limit only to a " laboratory ", still remain. The new outlook, wide, incorporate the objective and the subjective as object of science, with its methods and laws.

Freud in " Pulsions and their destinies " states how the ego of the subject facing difficulties and conflicts, has several possibilities and rescues especially two : the repression that will have as a cost the formation of the symptom or the sublimation, a creative act, proper of the human condition. The changes promote in a greater or lesser extent the disarrangement which in turn generates aggression. This aggression, if it can be adequately transformed, becomes a dynamic factor, a motor of change, existing an important interaction. The *status quo*, the monotonous routine, are usually the refuge in case of unknown and feared dangers, also connected to loneliness and abandonment. Scientific advances, artistic creations and even the everyday ludicrous creativity which for Winnicott is that which makes life to be worth living (Dellarossa, 1978), has as a center the possibility of abandoning a previous framework, in order to adopt new ones.

The vicissitudes of the creative act, while they imply the possibility of change, generate a mobilization with risk of a catastrophe, having the subject the danger of getting irreversibly lost, become insane or turn to self-destruction. We understand that the vicissitudes of creativity are given by the transit from conception up to the enclosing, of the initial chaos, towards its expression. Having clear that in the passage from the known to the unknown previous beliefs and knowledge are transgressed and fractured, it is necessary to be able to withstand the uncertainty, in a link with a new fact, concomitant to Frustration and to waiting, which implies the act of creating. The migrant who is deprived by a long loss of the reliable objects of his environment, suffers diminishment in his creative capacity. If the migrant has enough elaboration capacity, he will not only be able to overcome the crisis, but also it is possible that he realizes the emergence in himself of a creative potential which was unknown to him (Miramón, 1992).

Another important element to take into account in such a creative process, is the capacity to be alone. This capacity, placed at the service of the ego, is going to allow the transformation of psychic energy, available for the individual, which was connected to other affects, into energy for the development of creativity and thinking. In the case of somebody who migrates there is a lot of energy available that was previously occupied by : the family, friends, fellow workers, etc. This amount of energy released of the individual who migrates may be instrumented and be channeled through the organizations that contain the migrant, in our case the Caldas Network.

Bion explains how facing critical situations of life there could be a change in the subject called " catastrophic change " in which certain structures transform through changes, passing through times of pain, disorganization and frustration. These moments once elaborated and overcome are going to give the possibility of a true evolution and growth. In some way, the subject will have the opportunity of improving its creative potential, enriching himself with elements of the world that he has left and integrating the new acquisition, as source of stimuli

to project ahead a search for a task, a hope for life and a future (Bion, 1972, 1974).

Migration may also have painful consequences, to be invaded by a crisis and even to end up in a true psychic catastrophe. This is evidenced in clinical practice since the statistics of suicides in migrants is high. Yampey in an interdisciplinary approach on migration, studies the loss of the creative capacity in a social framework and states three causes :

1. the mechanization of the creative minorities ;
2. the inability by institutions to adapt to the aptitudes, emotions and ideas of the community ;
3. the " nemesis of creativity " which passive forms consists on the idealization of the individuals, institution or technique ; the passive form is usually the militarism and intoxication of victory (Yampey, 1982).

Caldas Network

An essential factor in the destination of migration is the reaction of the members of the receiving community. We have the painful experience, for example, of the maltreatment received by the Colombian nationality frequently associated with delinquents. To this respect, the sense of the institutional contention is very important. The Caldas Network, rescues, permits a rapid identity that has an influence in the settlement and adaptation. The person does not have to say that he is Colombian in search for..., he has an identity and this attenuates the distrust of the autochthonous community.

Another strong feeling in the migration processes, as already noted by us, represents the feeling of abandonment, the need for belonging. To some extent the Caldas Network meets this objective, permits to rescue the identity : is a Colombian scientist. It is clear that we are referring to certain migration conditions, since in the Caldas Network we take care of migration, where people have taken a decision to migrate, they have the means to do it and with some frequency, are going to return to the country. The migrant who lives more deeply the migration is one who makes a distant transfer, for an extended time, which would imply to " live " in another country and perform in it, everyday life activities.

Another transformation achieved through the Caldas Network is that of modifying and reverting the situation of " Brain Drain " which implies the abandonment of the country and to some extent the disconnection, a pseudo exile. Changing it for that of a scientist, serving his country, with possibility to join again its environment, Colombia, in his profession. It is a change of perspective of 180 degrees.

If we know that the Caldas Network is made up by an important number of migrants it is essential to know the psychological phenomenon of migration and creativity since the members of the nodes are to submit or have submitted to these vicissitudes, The identification of the process is vital since it permits the institution to be conscious of its presence in a specific time and be able to encourage so the creative act. This cycle is no doubt, favorable.

Charum (Charum, Parrado 1995) states as a priority in Colombia, the formation for consolidation of the research groups, the nonexistence of " crossed research " which would occur by the establishment of multidisciplinary team, different from the multidisciplinary work group. I would like to frame this difference given by the tendency in the multidisciplinary group to carry out researches in parallel, with the characteristic proper of the parallel lines that never touch. By opposition the work group that parts from an integration of the various disciplines. I believe that when the teams are enriched with the knowledge on their emotional processes and the situations of the individuals, such processes may be identified, prepared and enriched and even directed, for operations that they do to the institutions, the group and society.

The experience lived with the Argentinean Node of the Caldas Network (PROCIAR) has been very interesting, from this point of view. I had the privilege of being in the first line since they called me for the formation of the Node, which had failed in a previous attempt. I had been living in Buenos Aires for nine years and I started to look for and call Colombians with an answer full of enthusiasm and fantasies that exceeded the expectations. In general, they all stated their pleasure for this identity that the node enabled us, for the possibility of connecting again with the country, in their work and research areas. In fact to the majority it has permitted some accesses that were previously difficult to obtain for a foreigner, without a local institution supporting him. With this I do not attempt to minimize the personal efforts of each one of the members, but I do believe that in this node, the Caldas Network has been useful as a cane in climbing a mountain.

Argentina has attempted to make a similar network and two years ago, the Secretary of Science and Technology requested my services as representative of the Node for a logistical support. Up to now, they have not been able to make that intention concrete. I want to make clear that I find concretely serious instrumental faults in the Caldas Network, but I do not intend to discuss this subject here. What I wanted to show along my presentation refers to the emotional situations, the migration lived by the members of the node and the encouraging role of creativity by the Caldas Network for Colombians living abroad. It would be in other terms similar to rescuing the relevance of family for society, beyond the way of how this Pérez, Rodríguez, etc. family operates.

The attempt to go deeper into the subject, although it refers to the vicissitudes of the personal situation of the individuals, has a repercussion on the group and society. Its study, I believe, permits to open a scope of possibilities for a multidisciplinary team that may engage on the assessment of various elements, attempting to establish an integration, in “ cross fertilization ” the lack of which in Colombia is stated by Charum. This multidisciplinary team may, when known the situation of migration, take contributions from the various disciplines, encourage creative development and all of this will most surely be for the benefit of the Network, the members and Colombia.

Summary

Migration may be assimilated to the “ traumatic situation ” with the psychopathological alterations proper of this condition. The quality of the trauma comes from the sudden suspension of the customary acts of the external world. In the internal world of the migrant, stands out the loss of identity, since in most cases the individual, family and community peculiarities which make up the own being are disseminated.

Creativity, in these cases, may be the result of the form how the subject is able to transform the situations of confusion, chaos and mental pain, in factors for its growth. This represents a paradox since the situation of conflict may be a kind of counterpoint of the development of creativity, as one of the encouraging elements. In psychoanalytical terms it would be the possibility of undertaking a mourning that would permit the subject to perform a new psychic rearrangement.

Known the difficulties of the migratory process and the creative possibilities to which it may lead, by means of the reconstruction of a new identity abroad, its study could enrich the Caldas Network through the observation of the process. Also, it permits to prevent or assist in the serious and deteriorating situations, when the resolution is of a negative type and disintegrating of psychism. The intention is to discuss the ideas of this study with the objectives of the Caldas Network, attempting to inform about it at the process is facilitated and enriched.

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El proceso creativo en la migración : Desde la migración a la creatividad en la Red Caldas Aproximaciones psicoanalíticas

Beatriz Miramón Archila

Cuenta una leyenda peruana, que de la oquedad a la tierra, de la cueva del Pacaritambo (Posada del Amanecer) salieron los cuatro hermanos Ayar y sus respectivas esposas, equipados ornamental y utilitariamente e iniciaron un lento andar por punas y quebradas cordilleranas para encontrar un lugar apropiado dónde establecerse. Hermanas y hermanos fueron quedándose en el camino transformándose en piedras o huacas sagradas, mientras que Ayar Manco y Mama Ocllo, su esposa, continuaron su peregrinación preocupados sobremanera por hallar buenas tierras de cultivo.

Manco Cápac poseía dos varas mágicas, una de las cuales, al hundirse en la tierra señalaría el lugar donde deberían asentarse. Arrojó los dos bastones de oro, uno cayó en Colcabamba pero la tierra dura no permitió que hincase. La segunda la arrojó en un terreno llamado Guaynaypata, donde penetró suavemente. Este lugar fue llamado luego Cuzco, que según la lengua de entonces significaba ocupar un espacio.

Al llegar Manco Cápac y su gente al Cuzco la comarca estaba densamente poblada, pero sus habitantes les hicieron un lugar a los recién arribados" (Rorstorowsky, 1988).

Este mito de los hermanos Ayar fue creación cultural de los Incas. Ellos por medio de la palabra, intentaron mostrar los referentes históricos, o modos primordiales de pensar la historia y la sociedad. El mito consigna los deseos, temores y esperanzas arcaicos. Los mitos por su cualidad pictórica, nos permiten comprender las dificultades y vicisitudes que padecen los seres humanos, dan cuenta de la tradición oral. Nos abren un espacio para pensar y poder tolerar el dolor, debido a la renuncia a la omnipotencia, que implica el conocimiento.

La migración es una experiencia que se hace presente en la historia de la humanidad a través de mitos primordiales como el Edén, Babel, Edipo. Quizá convenga brevemente recordar dos corrientes migratorias masivas y sus consecuencias para la humanidad. Las tribus nómadas de Europa y Asia Central hacia Occidente, que coinciden con la caída del Imperio Romano. La migración de Europa y África del Norte hacia América, con Colón.

Este trabajo tiene por objeto el estudiar las vicisitudes que padece toda persona que realiza una migración, desde el punto de vista psicoanalítico, o sea las emociones, ansiedades y defensas inconscientes que acompañan al proceso. Investiga también la creatividad y la refiere al proceso de migración, por las coyunturas que durante éste evento se dan y pueden permitir su desarrollo, y aún la emergencia de actos creativos de los que el sujeto no tenia noción. Intento referir este fenómeno, a la Red Caldas, que con una amplia instrumentación es un terreno pertinente, en tanto tiene el privilegio de estar constituida por un conjunto de científicos, constituye un campo que por sus características, permite la observación del acto creativo. Este grupo humano tiene la vivencia de una migración. La Red Caldas les da a sus miembros identidad patria, los define como científicos colombianos en el exterior, este es uno de los elementos que permite al migrante una elaboración productiva de dicho proceso, que se transformará en beneficio personal y nacional.

Migración

Los psicoanalistas se ocupan hace mucho tiempo del tema migración. Freud el iniciador del psicoanálisis pasó por esa experiencia de chico (de su pueblo natal a Viena) y al final de su vida en que tuvo que migrar a Londres. Los pioneros en psicoanálisis fueron migrantes puesto que el psicoanálisis se desarrolló en Austria, Alemania y Hungría, antes de la segunda guerra. Por la situacion histórica la mayoría de estos pioneros tuvieron que vivir la experiencia migratoria.

En el consultorio privado las dificultades frente a la migración son evidentes en países con una población de migrantes como Argentina, donde la Universidad estatal en Buenos Aires tiene un "Centro de Atención al Estudiante Migrado" dependiente de la Facultad de Psicología, para asistir a los jóvenes que vienen a estudiar a la capital.(Bazan,1996).

En España el gobierno tiene una institución para "emigrantes retornados" dedicada a recuperar el idioma español y a evitar que se pierda la lengua del país a donde se migró, buscando rescatar así la importancia del enriquecimiento del acervo cultural que es propio de estos procesos. Israel posee instituciones especializadas en ocuparse del migrante tan pronto llega, para brindarle apoyo a los extranjeros migrantes que ingresan a ese país. Sólo para mencionar algunos casos.

Se han organizado eventos psicoanalíticos con el fin de pensar la migración. Uno de ellos fue el "Panel de psicoanalistas pioneros, sobre la experiencia migratoria", celebrado en la década del 70 en Filadelfia, con participación de muchos psicoanalistas de origen europeo que llegaron a EE. UU. por los años 30-40. Otro evento lo constituyó el "Encuentro de Psicólogos y Psicoanalistas de origen Húngaro", celebrado en Budapest en 1994.

El Doctor Ángel Garma, miembro fundador, de la Asociación Psicoanalítica Argentina, migró de España a Berlín para hacer su formación, luego estuvo en París y fue a Buenos Aires con el objeto de formar la Asociación Psicoanalítica Argentina, junto a otros europeos y argentinos formados en el exterior. La Sociedad Colombiana de Psicoanálisis fue constituida en su inicio por psicoanalistas formados en el exterior que retornaron a Colombia.

El tema reviste tanta importancia, que en Argentina está difundido a nivel de prevención en salud mental. Por ejemplo se trabaja los cambios de casa, preparando a los niños para las mudanzas, en forma semejante a como se hace para intervenciones quirúrgicas y por supuesto para realizar procesos migratorios.

Marta Bekei, migrante húngara, introductora de la Medicina Psicosomática en Argentina define la migración "...como un proceso complejo que obliga al individuo a enfrentarse con una serie de conflictos de cuya solución adecuada depende su éxito" (Békei, 1994). Llama migración al desplazamiento de personas de un país a otro sea voluntario o forzado, temporario o permanente. Estas diferencias otorgaran distintas características al proceso migratorio.

La experiencia no esta dada tan solo por el traslado, sino también por el proceso previo a la separación y el ulterior, la adaptación. Es una situación siempre dolorosa, centrada en el duelo que se debe elaborar. Su elaboración exitosa puede fortificar al yo o por el contrario sucumbir al trauma (Békei, 1994 ; Miramón y Barna, 1990).

El "Yo" tiene que soportar intensas angustias, defenderse de las ansiedades persecutorias y depresivas. En condiciones patológicas también de ansiedades confusionales, que surgen por la falta de discriminación entre las vivencias del país natal y las del de adopción (Miramón, 1992).

Los sentimientos contradictorios crean tensión y pueden provocar conflictos que imponen el trabajo de elaboración de duelo. El dolor de la separación crea fuertes sentimientos de culpa que activan defensas primitivas, produciendo síntomas, en muchos casos. (Miramón y Barna, 1990). El trabajo emocional se centrará así en la elaboración del duelo y en el intento de mantener la identidad personal, amenazada durante el proceso de cambio.

La propia identidad está dada por la sensación de seguir siendo uno mismo, es el resultado de la internalización de las vivencias del mundo interno y la pertenencia grupal o social, dada en un mundo exterior. Lo cotidiano, lo habitual son elementos estrechamente vinculados con la identidad, el sí mismo. El sujeto "es", vive "en", trabaja "en", etc. Con la migración el mundo del sujeto sufre un cambio y es necesario crear otras rutinas, actividades habituales o cotidianas.

El fenómeno se ha investigado desde varios vértices, uno es el del lenguaje y el sueño. Los sueños se caracterizan como traumáticos, se sueña reiteradamente con el viaje, por ejemplo. Este sueño permite en su repetición la elaboración de la situación de crisis. Es frecuente que se padezcan períodos de insomnio, con los consecuentes trastornos en vida cotidiana que este síntoma origina. (Békei, 1994).

Autores como Chomsky y Lacan nos permiten aproximarnos a la importancia del lenguaje y sus vicisitudes, proceso que el migrante afronta, teniendo que aprender una lengua nueva, o los modismos peculiares de cada país aunque se maneje el mismo idioma.

Chomsky destaca que el lenguaje no es una forma "mecánica" impuesta del exterior al sujeto sino un germen innato que se despliega desde el interior y que adquiere desarrollo de sus particularidades. Este autor plantea que el lenguaje hace posible instaurar un orden en el mundo ; sirve de órgano de pensamiento, de la conciencia y de la reflexión, dotando a la mente y al espíritu de una autonomía sobre lo vivido (Chomsky, 1965).

Lacan conceptualiza el lenguaje como preexistente al sujeto, haciendo una importante distinción entre significante y significado, estas dos relaciones no se recubren entre si. Lacan define significante como el conjunto de los elementos materiales del lenguaje, vinculados por una estructura ; es el soporte material del discurso. El significante es una estructura sincrónica del material del lenguaje. El significado es el conjunto diacrónico de los discursos. El significante posee autonomía con respecto al significado (Lacan, 1953).

Desde esta perspectiva, es claro, que en el proceso de migración tiene lugar un trastocamiento entre los significantes y los significados, con todas las dificultades que acarrea en el proceso de pensar.

La elaboración del conflicto puede realizarse sin patología o con ella. La solución patológica puede ser puesta al servicio de la adaptación, o puede impedir que se realice y llevar el proceso de emigración al fracaso.

La migración es siempre una vivencia dolorosa y traumática. La intensidad del trauma depende mucho de las condiciones externas e internas, pero son las internas las que dominan la manera de resolver el conflicto resultante.

El termino trauma que utilizo es mas amplio del que inicialmente utilizo Freud en la Etiología de las Neurosis para las experiencias traumáticas pasadas, ocurridas generalmente en la infancia y para lo cual aconsejaba como técnica especifica la catarsis. (Freud,1987). El trauma al que me refiero está en la categoría de los llamados "traumatismos acumulativos, silenciosos o de tensión" (Moses, 1978), con reacciones no siempre ruidosas y aparentes, pero de efectos profundos y duraderos (Moses, 1978).

Grinberg. lo describe así : "La migración no es una experiencia traumática aislada, que se manifiesta en el momento de partida-separación del lugar de origen, o en la llegada al sitio nuevo. Incluye, una constelación de factores determinantes de ansiedad y dolor que pueden o no, manifestarse clínicamente" (Miramón y Barna, 1990).

Dichas manifestaciones pueden darse en cualquiera de estas tres áreas :

* *Mental* (pánicos, estados de confusión, insomnio, rabia, pesadillas, terrores, temores, delirios persecutorios)
* *Corporal* (palpitaciones, enfermedades cardiacas, alérgicas, ulceras, cáncer)
* *Mundo externo* (accidentes, dificultades con la pareja o familia, conflictos laborales y sociales)

El sentimiento de “desamparo” es el sentimiento que caracteriza con mayor fuerza la vivencia migratoria. Y es frente a este sentimiento que se deben instrumentar, pensar, elaborar, los “continentes” adecuados para que el proceso sea exitoso.

A mi entender es uno de los vértices donde la Red Caldas “contiene” al científico colombiano migrante en el exterior.

Las migraciones se pueden considerar situaciones de crisis. Kaës dice que toda crisis implica una idea de “ruptura”, separación o arrancamiento (Kaës et al., 1979). El desarrollo normal del individuo trae consigo aparejado una serie de crisis, la crisis del nacimiento, la adolescencia, la edad media de la vida. La migración es una contingencia de la vida, potencialmente traumática, caracterizada por acontecimientos traumáticos parciales, y configura a la vez una situación de crisis. Las crisis son períodos de transición que representan para el individuo tanto una ocasión de crecimiento, como un peligro por el aumento de la vulnerabilidad y por lo tanto una posible desorganización mental.

Menges da un criterio de “emigrabilidad” intentando precisar las características específicas de las personas y sus condiciones potenciales para migrar. Plantea indicaciones y contraindicaciones frente al proceso, referidas a la capacidad o no, de superar la nostalgia (Menges, 1952 ; Garza y Guerrero, 1974 ; Dellarossa, 1978). La migración expone al sujeto a pasar por estados de desorganización, que van a exigir una ulterior reorganización. Pero esta no siempre se logra.

El migrante necesita de “un espacio potencial” para poder transitar a su nuevo mundo externo. A mi entender la Red Caldas facilita a sus miembros, la generación de este espacio, ayudando a encontrarlo, a manejarlo y a desarrollarlo. La Red Caldas actúa, a la manera de los “objetos transicionales” descritos por Winnicott (l976), que posee la característica de permitir la transición, o sea el paso, del binomio madre-bebe (Red Caldas - miembro), hacia el mundo externo (país donde se migra).

Puede también comprenderse desde el modelo de la Etología, donde la idea de migración que estamos exponiendo, se aproxima al “imprinting”. Que explica la tendencia de todo ser recién nacido, a acercarse a otro ser vivo, para que a nivel potencial pueda proporcionarle contacto y protección.

La mayor o menor gravedad de los trastornos desencadenados por la migración también dependerán en buena medida de la edad, características del grupo que acompaña a la migración.

No debe pasarse por alto el retorno. Los autores lo consideran otra migración con algunas características propias, dicen que quien ha migrado una vez se convertirá en cierta forma en un extranjero de por vida. El que retorna a su país de origen no pertenecerá al país en la misma forma que se fue, él ya no es el mismo y el lugar tampoco lo será. Se ha recorrido un camino en tiempos diversos, el sujeto que partió no será el mismo al regresar y cuando retorne será vivido por los del lugar como extranjero. También en este sentido se puede considerar migraciones los desplazamientos que se realizan dentro de un mismo país a regiones muy distintas. Esto se llama “migración interior” (Miramón y Barna, 1990).

Trabajar en el nuevo país es un hecho favorecedor del proceso. El trabajo es un factor organizador y estabilizador de la vida psíquica, reafirma la autoestima y permite reasumir una de las funciones de la adultez después del período regresivo de la llegada del migrante. El proceso de elaboración es la resultante entre la progresión y la regresión (Miramón,1992 ; Miramón y Barna, 1990).

Para concluir este aparte sobre la migración es conveniente resumir la etapas del proceso migratorio :

1) Sentimientos de dolor por lo perdido o dejado, temor a lo desconocido, vivencias de desamparo, soledad y carencia. Las ansiedades invaden al yo y producen una verdadera desorganización.

Este estado puede estar sustituido por una situación maníaca en que se minimizan las dificultades, o se magnifican las ventajas del cambio
2) Después de un tiempo variable el migrante empieza a sentir nostalgia y dolor por el mundo perdido, reconoce sus sentimientos y empieza a incorporar progresivamente los elementos de la nueva cultura.
3) Recupera el placer de pensar, desear y la capacidad de hacer proyectos para el futuro. Este nivel del proceso facilita la integración de la cultura nativa con la cultura nueva sin tener que renunciar a ninguna de ellas.

Creatividad

Sabemos las dificultades que para algunos científicos plantea la posibilidad de incluir el psicoanálisis entre las ciencias. Todavía a poco del siglo XXI, se mantienen férreamente las teorías positivistas, sin dar cabida a nuevos puntos de vista, subjetivos, que ya a principios del siglo XX planteaban físicos como : Einstein con su “Teoría de la Relatividad”, Heisenberg con las “Ecuaciones de Incertidumbre” y Bhorn con su “Modelo Metodológico Indeterminista”.

Esta situación no es nueva, de hecho Khun alerta sobre la dificultad del cambio a paradigmas nuevos, inaceptables para los científicos (Kuhn, 1992).

Permanecen las dificultades para ampliar los parámetros hacia un concepto moderno de ciencia, donde lo científico no se circunscribe tan solo a un “laboratorio”. El nuevo panorama, amplio engloba lo objetivo y lo subjetivo como objeto de la ciencia, con sus métodos y leyes.

Freud en “Pulsiones y sus destinos” plantea como el Yo del sujeto frente a las dificultades, conflictos, tiene varias posibilidades, rescata especialmente dos : la represión que tendrá como costo la formación del síntoma o la sublimación, acto creativo, propio de la condición humana.

Los cambios promueven en mayor o menor grado la desestructuración, que a su vez genera agresión. Esta agresión si logra ser adecuadamente transformada se constituye en el factor dinámico, en el motor del cambio, existiendo una importante interacción.

El status quo, la rutina monótona, suelen ser el refugio ante peligros desconocidos y temidos, también ligados a la soledad y al desamparo. Los avances científicos, las creaciones artísticas y hasta la creatividad cotidiana lúdica que para Winnicott es aquello que hace que la vida merezca la pena de ser vivida (Dellarossa, 1978), tiene como núcleo la posibilidad de abandonar un marco previo, para adoptar otros nuevos.

Las vicisitudes del acto creativo, en tanto implican la posibilidad de cambio, generan una movilización, con riesgo de catástrofe, teniendo el sujeto el peligro de perderse irremisiblemente, enloquecer o autodestruirse.

Entendemos que los avatares de la creatividad están dados por el tránsito desde la gestación, hasta el encierro, del caos inicial, hacia su expresión. Teniendo en claro que en el pasaje de lo conocido a lo desconocido, se transgreden y fracturan creencias y conocimientos anteriores. Hay que poder soportar la incertidumbre, en un vínculo con el hecho nuevo, concomitante a la frustración y a la espera, que implica el acto de crear.

El migrante deprivado con una pérdida prolongada de los objetos confiables de su ambiente, sufre disminuciones en su capacidad creativa. Si el migrante cuenta con capacidad de elaboración suficiente, no sólo podrá superar la crisis, sino que además es posible que se encuentre con la emergencia en él de un potencial creativo que le era desconocido (Miramón, 1992).

Otro importante elemento a tener en cuenta, en dicho proceso creativo, es la capacidad de estar

solo. Esta capacidad, puesta al servicio del yo, va a permitir trasformar la energía psíquica, disponible del individuo, que estaba ligada a otros afectos, en energía para el desarrollo de la creatividad y el pensamiento. En el caso de alguien que migra hay mucha disponibilidad de energía estaba ocupada antes por : la familia, los amigos, los compañeros, etc. Este monto de energía liberada del individuo que migra, puede instrumentarse y ser canalizada a través de las organizaciones que contengan el migrante, en nuestro caso la Red Caldas.

Bion explica como frente a las situaciones críticas de la vida en el sujeto puede sucederse un cambio que denomina “cambio catastrófico”, en el cual ciertas estructuras se trasforman a través de los cambios, pasando por momentos de dolor, desorganización y frustración. Estos momentos una vez que se han elaborado y superado van a dar la posibilidad de una evolución y crecimiento verdadero. En alguna forma, el sujeto, tendrá la oportunidad de mejorar su potencial creativo enriqueciéndose con los elementos del mundo que ha dejado, e integrando la nueva adquisición, como fuente de estímulos para proyectar hacia adelante en búsqueda de una labor, una esperanza de vida y un futuro (Bion, 1972, 1974).

La migración también puede tener consecuencias dolorosas, ser invadido por la crisis, y aun terminar en una verdadera catástrofe psíquica. Esto se evidencia en la clínica pues las estadísticas de suicidios en migrantes son altas.

Yampey en un enfoque interdisciplinario sobre migración, estudia la pérdida de la capacidad creadora en un marco social y enuncia tres causas :

1. la mecanización de las minorías creadoras
2. la incapacidad de las instituciones para adaptarse a las aptitudes, emociones e ideas de la colectividad
3. la “némesis de la creatividad” cuya forma pasiva consiste en la idealización de los individuos, institución o técnica, la activa suele ser el militarismo y la intoxicación de la victoria (Yampey, 1982).

Red Caldas

Un factor escencial en el destino de la migración es la reacción de los miembros de la comunidad receptora. Tenemos la dolorosa experiencia, por ejemplo, del mal trato recibido por la nacionalidad colombiana asociada frecuentemente con delincuentes. En esta dirección es muy importante el sentido de la contención institucional. La Red Caldas, rescata, permite una identidad rápida que influye en el asentamiento y adaptación. La persona no tiene que decir que es un Colombiano en busca de..., tiene una identidad y esto atenúa la desconfianza de la comunidad autóctona.

Otro sentimiento fuerte en los procesos de migración, como ya anotamos, lo constituye el sentimiento de desamparo, la necesidad de pertenencia. En alguna medida la Red Caldas cumple este objetivo, permite rescatar la identidad : es científico colombiano.

Es claro que estamos haciendo referencia a ciertas condiciones de migración, puesto que nos ocupamos de la migración en la Red Caldas, donde la gente ha tomado una decisión de migrar, cuenta con medios para realizarla y con alguna frecuencia, va a regresar al país. El migrante que vive mas profundamente la migración es quien realiza un traslado distante, por un tiempo prolongado, que le implique “vivir” en otro país y desarrollar en él, actividades de la vida cotidiana.

Otra transformación que se logra a traves de la Red Caldas es la de modificar y revertir la situación de “Cerebro Fugado” que implica el abandono de la patria y en alguna medida la desco-

nexión, un “pseudo exilio”. Cambiándola por la de un cientifico, al servicio de su patria, con posibilidad de vincularse de nuevo con su medio, Colombia, en su profesión. Es un cambio de perspectiva de 180 grados.

Si sabemos que la Red Caldas esta constituida por un numero importante de migrantes es escencial conocer el fenómeno psicológico de la migración y la creatividad pues a estas vicisitudes van a someterse o se han sometido los miembros de los nodos. La identificación del proceso, además de preventivo, es vital pues le permite a la Institución ser conciente de su presencia en un momento coyuntural y poder estimular así el acto creativo. Este ciclo sin duda es favorecedor.

Charum (Charum y Parrado, 1995) plantea como prioritaria en Colombia, la formación para la consolidación de los grupos de investigación, la inexistencia de “investigaciones cruzadas”, que estaría dado por la constitución de un equipo multidisciplinario, diferente del grupo multidisciplinario de trabajo. Quiero remarcar esta diferencia, dada por la tendencia en el grupo multidisciplinario a realizar investigaciones en paralelo, con la característica propia de las líneas paralelas que nunca llegan a juntarse. Por oposición al equipo de trabajo que parte de una real integración de las diversas disciplinas.

Pienso cuanto se enriquecen los equipos con el conocimiento sobre sus procesos emocionales y las situaciones de los individuos, pues dichos procesos puede identificarse, elaborarse, enriquecerse y aun encausarse, para mejorar los funcionamientos que hacen a las instituciones, al grupo y a la sociedad

La experiencia vivida con el Nodo Argentino de la Red Caldas (PROCIAR) ha sido muy interesante, enfocado desde este punto de vista. Tuve el privilegio de estar en la primera línea pues me llamaron para convocar a la formación del Nodo, el cual había fracasado un intento previo. Llevaba nueve años viviendo en Buenos Aires y empecé a buscar y a llamar a colombianos con una respuesta llena de entusiasmo y fantasías que superaban las expectativas. En general todos manifestaban el agrado por esta identidad que el nodo nos posibilitaba, por la posibilidad de vincularse de nuevo con el país, en sus áreas de trabajo e investigación. De hecho a la mayoría le ha permitido ciertos accesos que anteriormente eran difíciles de conseguir para un extranjero, sin institución del lugar que lo respalde. Con esto no pretendo minimizar los esfuerzos personales de cada uno de los miembros, pero si pienso que en este nodo, la Red Caldas ha sido útil como un bastón en el ascenso de una montaña.

La Argentina ha intentado implementar una red similar y hace dos años, la Secretaría de Ciencia y Tecnología, solicitó mis servicios como representante del Nodo para un apoyo logístico. Hasta ahora, no han logrado concretar esta intención.

Quiero aclarar que encuentro en lo concreto serias fallas instrumentales en la Red Caldas, pero de ese tema no pretendo ocuparme acá. Lo que quise mostrar a lo largo de mi exposición está referida a las situaciones emocionales, por la migración, que viven los miembros de los nodos y el rol estimulante de la creatividad de la Red Caldas para los colombianos residentes en el exterior. Sería en otros términos similar a rescatar la relevancia de la familia para la sociedad, mas allá de cómo funciona esta familia Pérez, Rodríguez, etc.

El intento de profundización sobre el tema, si bien se refiere a vicisitudes de la situación personal de los individuos, repercute en el grupo y en la sociedad. Su estudio pienso, permite abrir un abanico de posibilidades para un equipo multidisciplinario que pueda abocarse a evaluar los diverso elementos, intentando constituir una integración en “alimentación cruzada”, cuyo carencia en Colombia plantea Charum.

Este equipo multidisciplinario puede al conocer la situación emocional propia de la migración, prevenir, tomar recaudos desde las diferentes disciplinas, estimular el desarrollo creativo y todo esto seguramente redundará en beneficio de la Red, los miembros y Colombia.

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Information Technology as a Search Mechanism for Brain Gain

Greta Pifat
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Introduction

During decades the brain-drain of scientists from Croatia did not attract public attention nor governmental concern. There were a few empirical sociological studies trying to analyze the brain-drain and social profile of scientists-emigrants (Golub, 1988) the motives of scientific migrations (Prpi}, 1989) the potential exodus of Croatian scientists (Prpi} et al.,1990). From these studies we can ascertain that the Croatian scientific diaspora is big and spreads all over the world. The reasons for it are sometimes specifically for scientific motives (Adams, 1968) as primary factors, but economic and/or political factors should not be neglected. Whatever the reasons for scientific migrations, it is important to stress that the sporadic interaction of Croatian migrated scientists with domestic ones has always been present on an individual level for reasons inherent to the communication patterns of scientific activity, but also probably due to patriotic impulses.

Communication between diaspora and local scientists has become of utmost importance as Croatia is a recently established independent state contemplating recovery from the war devastations. In order to improve the interaction of domestic and diaspora scientists in a systematic fashion and as a way to promote the interaction itself, a database of scientists was established under the auspices of the Ministry of Science and Technology. The criteria for the establishment of the database and for the selection of the scientists to be put in it will be described in section 2. Section 2.2 will present the envisaged uses of the information stored in the database and will highlight the advantages of having this information available in machine readable form. The third section of the paper will explore the ways in which e-mail and INTERNET based services can be used as a systematic methodology for the location and updating of an international database of diaspora scientists, irrespective of their country of origin. The fourth section will detail the activities necessary for the establishment of a world-wide database of scholars in the diaspora. The conclusions are presented in the fifth section.

Database creation: Selection criteria and methodology

The original impetus for the database came from the need to improve the evaluation mechanisms for scientific projects financed by the Ministry of Science. It was therefore proposed to develop a broad international pool of referees from all scientific fields : natural, biomedical, technical, biotechnological and social sciences as well as humanities. The logistical organization of the referee's pool was located at the Ministry of Science and Technology.

It was necessary of the one hand to find experts (irrespective of their place of birth) who would be willing to use their knowledge and critical approach for the evaluation of projects submitted by Croatian scientists for domestic funding. It was felt that our depleted domestic population of scientists by itself would be unable to achieve a critical mass for optimum peer review processes to take place. It was necessary on the other hand to locate Croatian scientists working abroad because they would be more familiar with the limiting conditions characteristic of scientific activity within the scientific periphery.

Croatian scientists working abroad could help the Ministry to establish, promote and adhere to standards and criteria per scientific activities comparable to those of prevalent in more developed scientific communities. It was therefore decided that the pool of referees would be composed of domestic professional scientists, Croatian scientist working abroad, and internationally recognized scientific figures irrespective of their place of birth.

Different channels were explored in order to establish preliminary contacts : personal contacts, paper correspondence with different institutions and particularly e-mail interaction were used. E-mail was particularly useful to identify scientists of Croatian origin who are now living and working abroad. Letters were sent to the scientists explaining the purpose of the database and an invitation to submit their curriculum vitae in order to join the pool.

Database composition

The database is comprised of over 1500 records out of which 900 are international scientists. More than six hundred addresses of Croatian scientists working abroad have been collected. Table 1 presents the distribution per subject area of scientists that were approached and the number of these scientists that agreed to submit information for inclusion in the database.
More than fifty percent of scientists agreed to act as the referee candidates sending their full addresses, field of interest and the list of subdiscipline fields where they are experts. It was very optimistic that more than 350 scientists have shown the willingness to contribute to such an important step in scientific activity. It is interesting to observe from the Table I. that : a) the

Table 1. Scientists per scientific field who have agreed to join the referee's pool

Scientific Field	Approached	Agreed
Natural sciences	180	104
Biomedical sciences	163	90
Technical sciences	81	57
Biotechnical sciences	20	16
Social sciences	59	42
Humanities	74	46
Interdisciplinary	1	1
Unknown fields	55	7
Total	**633**	**363**

Table 2. The number of scientists per countries

Country	Number of scientists	Country	Number of scientists
USA	293	Canada	66
Germany	46	Switzerland	40
France	27	Austria	19
UK	16	Australia	14
Bosnia and Herzegovina	13	Sweden	10
Netherlands	9	Italy	7
Belgium	3	Denmark	3
Slovenia	3	Monaco	2
Chech Republic	1	Greece	1
Island	1	Other	59
Total	**412**	**Total**	**221**

dominant scientific migrants are from the field of natural, biomedical and technical sciences. This, of course, is easily interpretable in the light of general scientific migrations, b) their response to our questionnaire was around 55 %, c) although the absolute number of scientists in the field of biotechnical and social sciences as well as humanities are smaller, their response to be included in the referee's pool is significantly higher (80 %).

The geographical distribution of our diaspora scientists shows (Table 2) that the USA is the scientifically most attractive immigrant country followed by Canada, Germany and Switzerland. In many countries in Europe, Asia and South America we have found only one scientist per country in the required status assistant professor, associated professor and full professor.

Potential uses of the database and future activities

There are many different ways to improve the interaction between domestic scientists and diaspora ones.

Establishment of a programme of visiting professorships

The teaching and research experience of diaspora scientists could be used by Croatian universities through the sponsorship of visiting professorship. Individually this involvement has taken place even earlier but we would like to install institutionally the visiting professorship particularly in the fields of social sciences and humanities to expose young students to undoctrinated approaches. Of course, this educational " refreshment " could be of benefit to all students in other fields as well. It is not necessary to mention that the advantage of our diaspora lecturers is no language barrier.

Predoctoral fellowships

A programme of predoctoral fellowships would enable our Ph.D. students to finish their Ph.D. thesis abroad (particularly in experimental areas) since economic problems hinder the access to materials, equipment, etc. The diaspora mentors will benevolently be included in Ph.D. exams at Croatian universities so that the students will get domestic diplomas.

Postdoctoral fellowships with diaspora mentors

In our opinion, Croatian postdoctoral fellows would benefit more from the mentorship with a diaspora scientists than from a non-Croatian scientists. Tradition we would hope that the brain-drain phenomena will be less frequent in the case of diaspora mentors.

Access to international funding

A very important step in the interaction of domestic and diaspora scientists is scientific cooperation through joint projects financed by different sources better known by diaspora scientists. The potential of domestic scientific communities in all scientific fields is illustrated in the book " Scientific Research in Croatia " (Pifat-Mrzljak, 1995) just published by the Ministry of science and technology.

Scientific exchange

Connected with the joint projects is scientific exchange not only with the scientific institutions, universities, but scientific societies, libraries, etc.

Meeting of domestic and diaspora Croatian scientists

Actual meetings of scientists would not be excluded. Namely, we are planning to bring together all our scientists to a meeting in Croatia were different possibilities of interaction will be discussed, particularly formalized institutional cooperation.

Future activities and methodological proposal

We believe that by means of new information technologies the brain-drain can be converted to brain-gain for the benefit of national science even without the process of migration. However, those technologies have not yet been exploited to their full potential. For example, in the case of the development of the Croatian database, it was particularly difficult to build the original list of scientists from personal contacts. We are therefore interested in exploring a methodological approach that exploits more fully the capabilities of electronic mail and INTERNET related services for the benefit of national scientific strategy and policy as well as for education process. Namely, we are proposing to explore a methodology for approaching scientists that by-passes personal contacts. We are interested in locating scientists from the diaspora via means of specialized electronic discussion lists managed through listservs and related INTERNET technologies.

Listservs and discussion lists

Discussion lists are useful and important sources for the exchange of information. Scientists and scholars throughout the world connect to those lists to put forward new ideas and debate items of research. Discussion lists are also used to disseminate announcements of conferences, debate the proposed agendas of the future conference or meeting, review recent publications, participate in calls for papers etc. In short, electronic discussion lists embody the essence of scholarly communication in a non-formal manner by allowing scholars to participate in the flow of ideas from their own offices. A “ listserv ” is the software that allows for the easy management of the flow of messages from the originator of the message to a central listserv address and the subsequent dissemination of the message from that central address to all the members of discussion group (Gilster, 1993). Usually, each discussion group is monitored by one individual who via the use of the listserv programme ensures the correct functioning of the discussion group both from its social and technological aspects. There are now several other programmes such as MAILBASE (for the UK), LISTPROC and MAJORDOMO who have roughly the same functions as a “ listserv ” but are housed on different machines. The name “ listserv ” is however, used generically to refer to the software that allows for the administration of the flow of messages of a discussion list.

There are presently over 3000 listservs in every subject imaginable (Whiney). Several directories of listservs are searchable on the WWW. For example the LISZT database (http ://www. liszt. com) includes over 34000 discussion lists catalogued by subject area. It is therefore possible to search electronically for a number of discussion lists, determine there listserv addresses and explore the possibilities of systematically contacting diaspora scientists and scholars from any country of origin in order to create a world-wide database of diaspora scientists.

Objectives

Primary objective : To explore the feasibility of discussion lists and listservs as means of contacting diaspora scientists from any country of origin.

Secondary objectives : To develop a WWW homepage of the project ; to develop a self-administered questionnaire, (in several major international languages) accessible from the WWW ; to maintain and update a world-wide database of diaspora scientists using the information from the self-administered questionnaires.

Methodological activities

Determination of discussion lists

To identify through electronically searchable directories the lists that are most likely to attract scientific and scholarly discussion of high calibre. Ideally we should be able to contact at least two lists per scholarly discipline.

Questionnaire design

The questionnaire should include demographic data as well as academic trajectory data. Language competency and consultancy experience outside country of work/country of origin should be included. Optionally, some publication data (limited) could be included.

Design of database structure

To design relational database structure with boolean logic searching capabilities per field and in free text format.

Homepage design

Determine the design and structure of the WWW homepage for the project, with rational links to the questionnaire and to other areas of interest (funding organizations, project manager(s), etc.).

Conclusion

This paper has presented the steps taken to develop a database of Croatian scientists in the diaspora. The database will be used to strengthen the interaction between diaspora scientists and scientists in Croatia. It is expected that as a database becomes better known more scientists will be willing to join the project. However, the experience of building the database from the starting point of personal contact has lead to the realization that the information technologies particularly those related to INTERNET services can be used to their full potential to develop a world-wide database of scholars in the diaspora. The technology is available for such an endeavour ; all that is lacking is some form of material support and the willingness of interested individuals to collaborate.

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Globalization of the National Scientific Community through Electronic List: Lessons and Prospects from a Case Study in Colombia

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Introduction

One of the main devices of the Caldas Network “Colombian Network of Researchers and Engineers Abroad”, is constituted by its electronic list called R-Caldas. This network connects, since January 1993, several hundred people in numerous countries, which exchange messages published jointly. Most, although not all of them are of Colombian nationality. The list represents the only permanent collective space of the Colombian scientific community abroad and to this respect becomes the symbol of its identity ; to such extent that the network as a whole is frequently confused with its single electronic expression. We have prepared a systematic study of the communication through the R-Caldas list since its origin, in January, 1993, until the beginning of 1996. The above represents more than 1,000 messages analyzed in a data base of 30 fields characterizing each of them.

Through this data base the objective of our study is double. It consists first in learning this new phenomenon that constitutes the electronic communications activity. To this respect this is a pioneer and unpublished experimental study. The second objective of this study is to examine concretely a contribution by INTERNET to the scientific development, between the local community and the groups of emigrated scientists worldwide. Therefore, it is also a documented trip to the heart itself of the postmodern myth : the planetary village. Without attempting to answer here all the inquires arising from the study, we have chosen to deal with four essential considerations :

- does the electronic list constitute an attractive, stable and dynamic meeting space for the members of the groups of emigrated scientists worldwide ?
- how is the issue and receipt of messages characterized through this list ?
- what does the communication consists of and what are its contents ?
- in what way does it fertilize the relations between the group of emigrated scientists and the local Colombian community ?

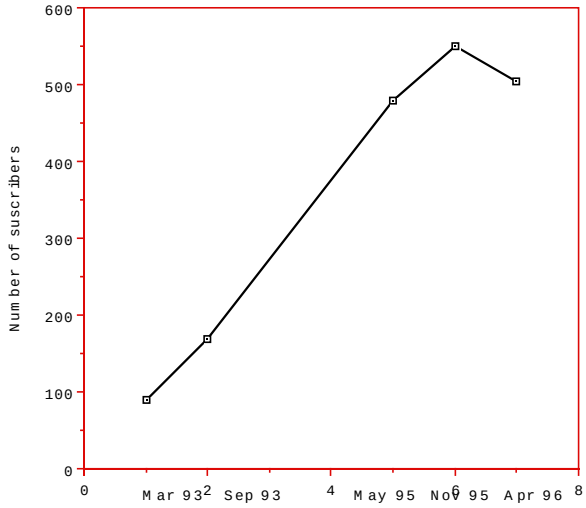
These questions lead us to examine the results of the exploitation of the base in four successive points :

I- The evolution of the participation in the R-Caldas list.
II- The issuing activity and intensity.
III- The contents of the communication.
IV- The scientific work through the electronic network.

Evolution of the Participation in the List

Exponential growth

The evolution of the number of people enrolled in the list shows a marked increased throughout the period, passing from 90 two months after its creation to 551 almost three years later (Graph 1). The slight decrease observed at the beginning of 1996 (505 enrolled as of April, 1996) coincides with a reorganization of the electronic list made by its managers. This sustained expansion in the number of enrolled people is a sign of an actual dynamism : more people are increasingly having access to the electronic list and connect to it.

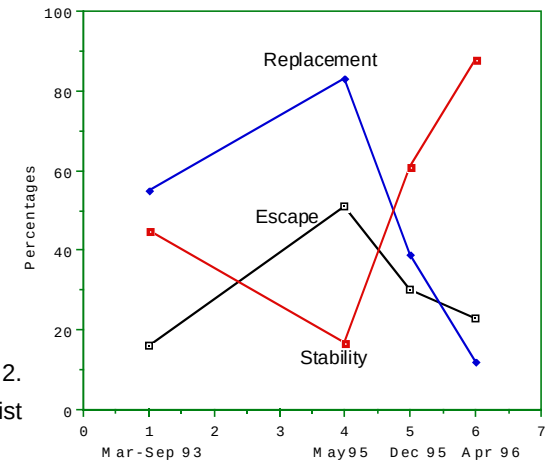


Graph 1.
Evolution of the participation to the R-Caldas list (Mar.-April 96)

An evolutionary and relatively stable list

In total, at least 874 people have been connected at one time or other to the R-Caldas list. It is a minimal figure obtained by the measurement of the population in five electronic census made at different times. There may be a case in which there could have been more participants who have not been taken into consideration, if they came in and went out between two census. Particularly, the year 1994 which has not been covered may present this case. In any event, the figure of 874 means that there are people coming and going, or at least entering and leaving the list. Graph 2 gives us information about three aspects to characterize the movements, the transformations, in the composition of the list.

- withdrawals, rate of evasion (escape)
- entries, rate of renewal (replacement)
- stays, rate of stability (stability)



Graph 2.
Transformations in the composition of the list

These data indicate that the R-Caldas list is evolutionary. The population is not fully the same at the beginning and at the end and there is a permanent renewal in its composition. However, this renewal is partial and a lot more continuity is observed than withdrawals. In particular, the graph shows a net tendency to the stabilization of this population. The R-Caldas list seems to have reached a development threshold, with weak renewals and losses, close to 500 members.

In any event, the population of the electronic list does not appear as a “volatile” population. The list is in effect a transient place to which people do not belong eternally, but where transitory ties are established which are increasingly durable. There is a certain loyalty to the list. This stable, continuous, progressive nature of the composition means that the list represents a community space, naturally not of an immobile community but of a community with a tradition, orientations and communications standards transmitted and supported by the collective practice.

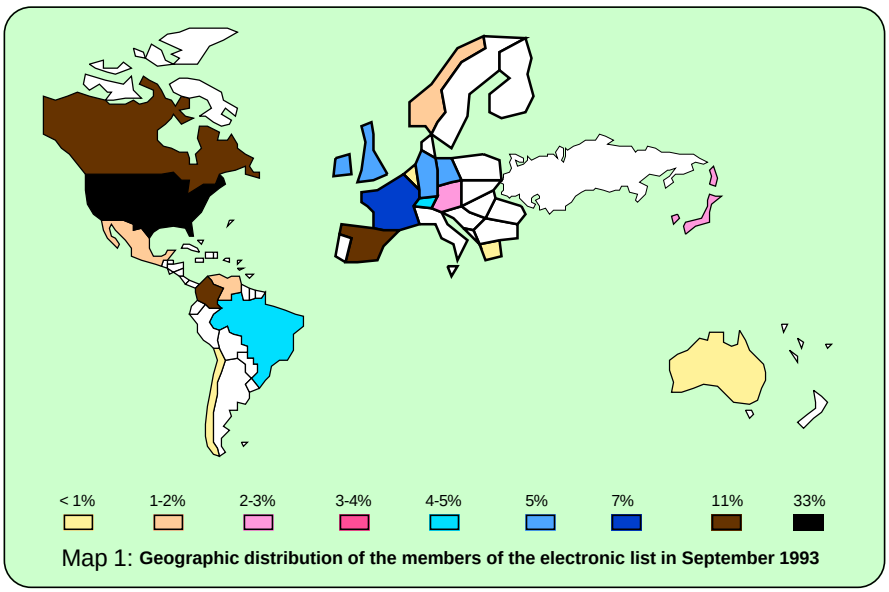
Increasing participation by the scientific community in Colombia

A geographic evolution in the composition of the participants in the list is evidenced. Initially very frequently concentrated in North America (United States and Canada) and Europe (France, Spain), the participation becomes diversified (goes from 13 countries in March 1993 to 26 countries three years later) and Latin America passes to hold a much more important position (mainly Colombia and Brazil) becoming the region with the largest number of participants (see maps 1 and 2).

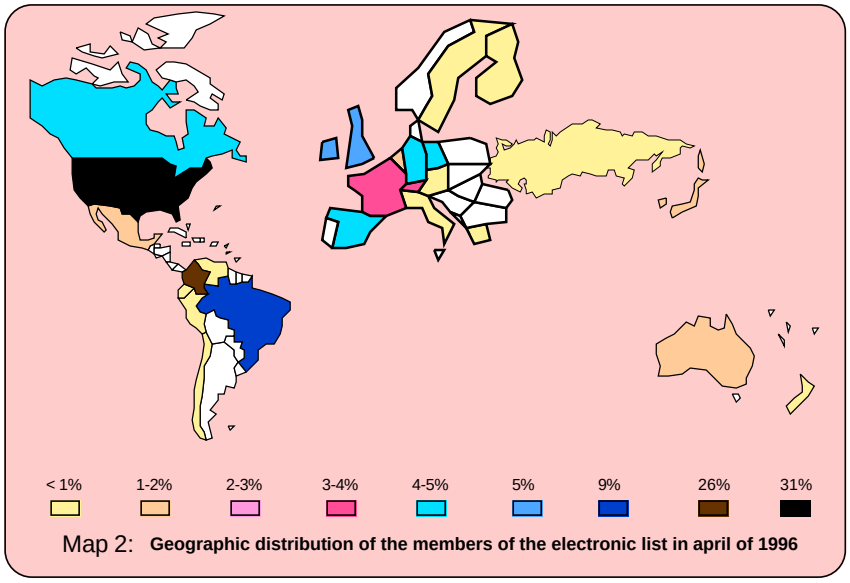
Here it is possible to evidence two phenomena :

- The development of the electronic networks in the developing countries, where strong Colombian affections are found (mostly Latin American countries).
- The internalization in Colombia of the Caldas Network; INTERNET undoubtedly opened the possibility to the residents to communicate with their expatriate peers and they took advantage of the opportunity. Colombia is now the second country in number of people enrolled (more than one fourth of the total), after the United States and far ahead of the remaining countries. It is also the country that shows, both as percentage and as absolute figure, the higher growth of connections to the network, which proves an internal diffusion of the network and maybe the end of an eccentric group of expatriate scientists.

Also, it is possible to observe a certain stalling and sometimes even a slight decrease in the participation in absolute value of certain countries : Spain, France, Mexico, Canada, Austria and even the United States, although to a lesser extent. Would this be the presage of a potential satu-



Map 1: **Geographic distribution of the members of the electronic list in September 1993**



Map 2: **Geographic distribution of the members of the electronic list in april of 1996**

ration of communication in these zones or the weariness of the participants from these countries ? It seems significant that these countries will frequently be those that first connected and have renewed little their participants. It is also necessary to consider that there are dissident or local lists that exist internally.

The geographic and institutional dispersion of the members of the list.

The network is disperse both geographically and institutionally. Few people enrolled in the list have a close by electronic address. Most of the members are “isolated, at some moment of the period. For them the network creates, therefore, a proximity, without which it would not exist. The physical social ties do not seem to have a great impact on the electronic network. The people who have enrolled have done so without local community, except maybe within Colombia itself.

However, an increasing concentration of effective members is observed : it has gone from close to _ isolated at the beginning to almost half not isolated at the end. The number of institutions decreases from May, 1995 to April, 1996, while the number of participants increases. The phenomenon is related to the “Colombianization” of the list : the large Colombian institutions concentrate an important number of members (Univalle, Colciencias, Uniandes, UNC, Javeriana). They are massively located in Bogota. If these Colombian institutions would retire, the list would be extremely disperse with some small local concentrations like in Brazil, for example, but which do not exceed 5 people enrolled of the same institution. Therefore, the group of expatriate scientists is disperse, while the Colombian electronic community is agglutinated in some institutions. From a cloudy origin, the network goes on to acquire progressively the form of a centered system, in Colombia.

Issuing Activity and Intensity

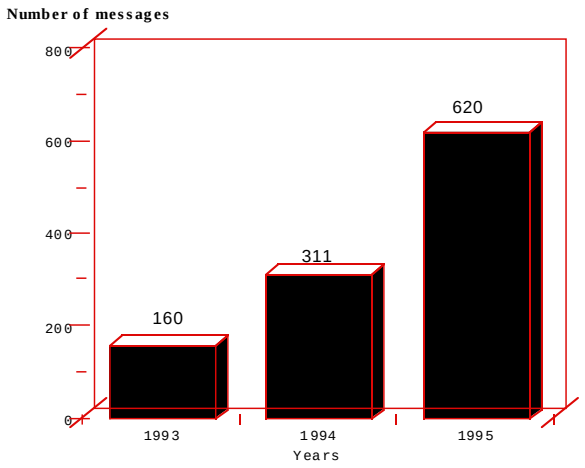
Massive growth of number of issues

The quantity of messages issued is doubled every year (Graph 3).

The above translates into a progressive density of communications. In 1994 the days of issue represented 39 % of the days of the year, with an average of 2.2 messages per day of issue. In 1995 the days of the year which constitute days of issue are 56 %, with an average of 3 messages a day.

In 1994, half of the messages have a frequency of issue of 1 per day, and the other half is in a

range from 2 to 10 per day, with a low number of days of high frequency of issue (> 3 messages/day). This means that there is a dispersion and most of the messages are issued at a rate of one, two or three per day. Evolution is very sensible in 1995 : there are less days in which only one message is issued and the days of issue with a minimum of two messages (maximum twelve) are twice as numerous. Most of the messages are issued at a rate of 3, 4, 5 and 6 per day. This means that the issues become strongly more dense and communication outstandingly intensive. The above modifies the reception : more messages are received, more often and each message generally comes accompanied by others.



Graph 3. Number of messages per year

However, if this issuing activity is compared with that of other electronic lists sometimes less numerous regarding the number of people enrolled, it is possible to evidence that it is quantitatively weak and of a relatively modest intensity. That is due to the communication nature of the list, as we will show below.

Polarized issuing activity

The issuing activity is at the same time concentrated and disperse. An important number of different institutions and individuals issue at one time or another, but most of the issues are concentrated around some of those institutions or some of those individuals.

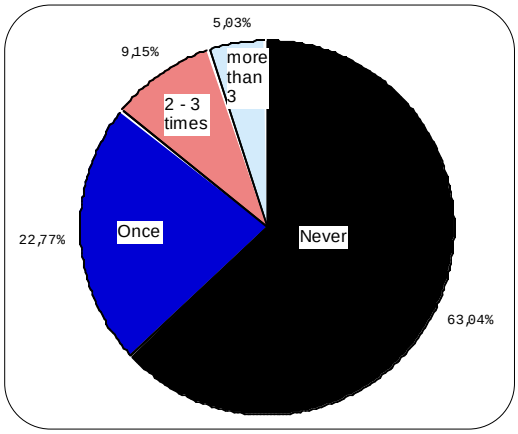
Issuing people

It is possible to observe that the population of the list is constituted mostly by “lurkers” -furtive members (so called by those responsible for another electronic list, of sociology of science)- who never issue. Approximately two out of three people enrolled are in this situation (Graph 4).

In addition, among those who issue messages, the part of the exceptional issuers represents also close to 2/3. Those who issue occasionally represent a little less than 10 % and significant issuers hardly reach 5 %. The intensity of the communication activity, or at least issuing activity, is inversely proportional to the number of issuers.

This polarization phenomenon is not surprising and seems to correspond to a current electronic practice.

If we consider the part of the electronic communications attributable to the different category of issuers, it is observed that more than 2/3 of messages issued (68 %) come from occasional issuers (from 3 to 9 messages during the period), from the frequent issuers (from 13 to 41 mes-



Graph 4.
Proportion of senders by frequency of emmissions

sages during the period) and from the coordinator of Colciencias (232 messages during the period (Graph 5). On the other hand, the categories of exceptional issuers (1 message during the period) and casual issuers (2 messages during the period) represent only 1/3 of the total of the electronic communications.

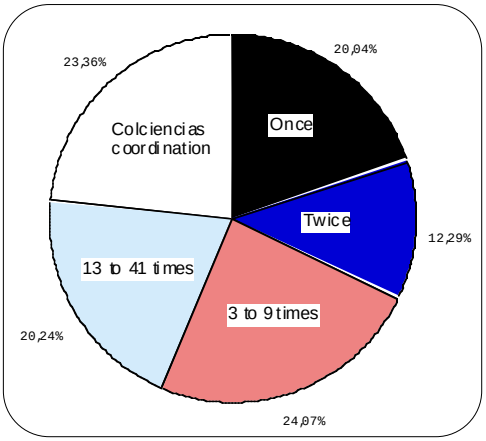
What is the meaning of these figures ? That the communication space is known and is marked. It has been marked by people, who are identified. A person issuing more than three times, is indeed identified by the others and has the opportunity to be recognized, the following times. Electronic communication is not anonymous and the sense is not fortuitous, the contents are frequently constructed with a certain premonition of what the reactions can be. The interpretation of the sense is made as a function of these points of reference. The paradox is that the rest is a black hole but notwithstanding is made up by the majority of those who receive and therefore also those who interpret.

Issuing insttutions

There are 165 issuing institutions.
78 issue once (47 %)
29 issue twice (18 %)
40 issue from 3 to 10 times (24 %)
18 issue more than 10 times (11 %)

The institutional dispersion is less frequent than the individual dispersion but, however, it is more significant. And the polarization is evident : 11 % of the institutions issue 2/3 of the total messages.

An interesting phenomenon : although it is true that none of the large individual issuers is Colombian (except the Colciencias coordinators), it is also true that 5 Colombian institutions are among the 17 large issuers, and represent 35 % of the communications issued by this cate-



Graph 5.
Proportion of messages by category of senders

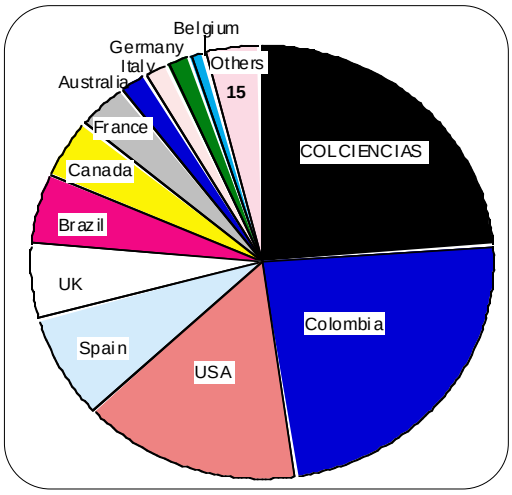
gory (eliminating Colciencias). This means that communication in Colombia is personalized to a minimum and is distributed among a wide range of people. We again find the large institutions enrolled (Univalle, Uniandes on top, the “electronic active” ones) with a vanishing of the other two large members of Bogota, UNC and especially Javeriana in benefit of the provincial issuers (Eafit and Uniantioquia), dynamic although not very numerous.

Colombia: issuing center

There are 28 issuing countries (Graph 6). Issuing is more or less disseminated or concentrated according to the countries. Highly concentrated in Switzerland (20 per institution in average), in Italy (8) and in Spain (7.5), it is less so in Colombia (with a little less than 6 if the coordinator from Colciencias is excluded) and in Canada, Brazil, Belgium and France (between 4 and 6) ; in the United States it is hardly concentrated (3) and in Germany is very disperse (1.2).

Colombia has an issue rate higher than the average of those enrolled, and so has Australia and inversely the United States. The remaining countries are more or less equivalent : their issuing percentage corresponds, to a large extent, to that of their number of members.

These figures permit to think that the “furtive” participants are less numerous in Colombia ; those of Switzerland, on the other hand are very numerous ; it is observed then, a strong contrast according to the countries. It could be that the connection to the list be made for different reasons, according to the place of residence. In Colombia, for example, the people connect both to transmit information and to receive it, while among the group of expatriate scientists the Network serves more as a constant information tool about the academic activities of the country and those of the fellow citizens abroad. It is a posture that we call : “individual strategic surveillance”.



Graph 6. Emissions by country

Contents of Communication

Sustained academic communication of a national nature

Communication languages

895 (87 %) of the messages are in Spanish
39 (4 %) in Spanish and English
91 (9 %) in English
1 in Spanish and Portuguese

The dominant language is by far Spanish. English is only used, jointly or by itself, in 13 % of the cases. The list is, therefore, eminently Latin and Spanish speaking ; even if it is a worldwide and scientific list, it does not adopt either the international language or that of science. The messages in English are, frequently, importations : text from abroad, announcements of events, of employment, of scholarships, etc. This language is implicitly known since there are more in English than in Spanish-English but it is the language of communication, as neither are French or Portuguese languages notwithstanding the fact that some members of the list are not Colombian.

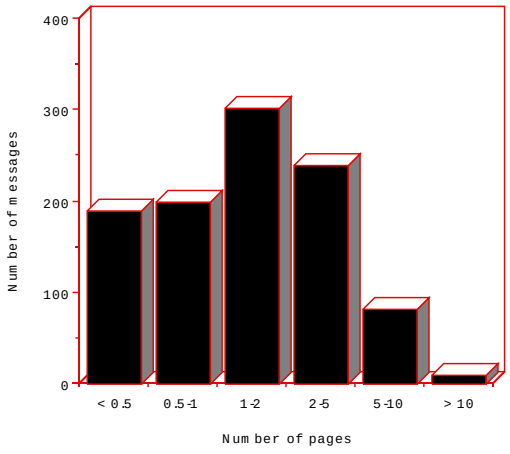
Length of the messages

We can distribute the messages as a whole into categories defined according to their length :

- less than half a page ; these are short messages that provide a brief information, a spontaneous reaction, an exchange of contents scarcely developed.
- between half a page and one page ; these are more elaborate messages, the equivalent of a letter, which demand a few minutes for drafting.
- from one to two pages ; the equivalent of a long letter, a prepared exchange, or at least to which a certain time of expression is dedicated.
- from two to five pages ; this is a very developed communication, with a substantial content, which requires a consistent elaboration on the part of the writer and a considerable reading time
- from five to ten pages ; it is a very elaborate information, generally prepared in advance and disseminated at a later time ; the contents are evidently very substantial.
- more than ten pages : exceptional cases, transcription of long articles.

Graph 7 indicates that the majority of the messages are from 1 to 5 pages long. This reveals an evidently elaborate communication. Most of the messages are frequently worked on and prepared in advance. This is probably the case of all those which exceed two pages and which are the remittance of “imported” texts. They come, in effect, either from other electronic lists or from an environment outside from “electronics” and are passed to the network which acts then as a rotating platform of previously prepared information. In the case of messages from one to two pages, these could be previously prepared texts but also written directly for the network. However, in the latter case, it is a built, structured text which refers to an elaborate communication work. In average, the network contains, therefore, substantial information in terms of contents, which has been obtained through a previous work, performed in the course of the connection or prior to it. But the network is also a place of spontaneous and immediate communicative life. The part corresponding to short messages is not to be disregarded, even if it is a minority.

The list involves, therefore, two aspects : first, it constitutes a space of exchange of prepared information, which represents the work of actors that can be retrieved by means of the elec-



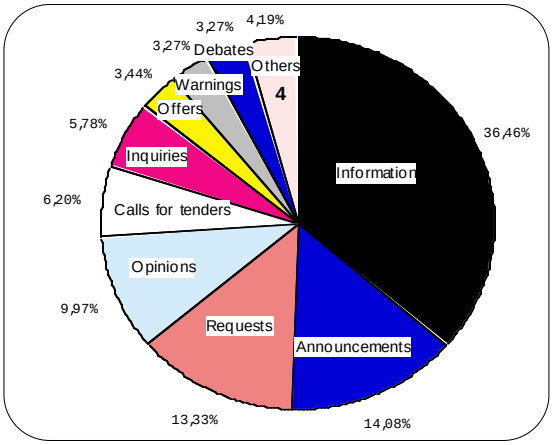
Graph 7. Size of the messages

tronic circulation ; but it is also the place of immediate expression, of an instantaneous sharing with short exchanges. Other INTERNET lists are a lot more centered on short messages, in a forum of exchanges between multiple participants, as if it were a discussion around a table. This is one aspect of the R-Caldas list which appears similar, in some way, to an academic information bulletin, a newsletter in which the contents are rarely as much developed as in a colloquium or in a scientific magazine, but are indeed sufficient to feed the personal work of the receivers.

Instrumental, a lot more than social, use

The large categories of messages

181 (18 %) messages have a double content. There are 13 large categories and 35 types of different messages (Graph 8).



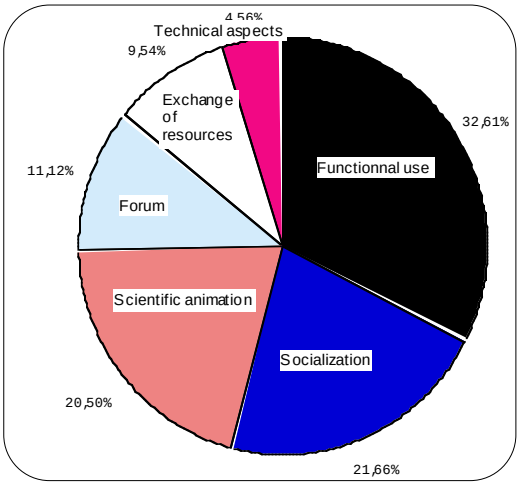
Graph 8. Types of messages

If the list is considered as a place where different transactions are carried out, in which communications are exchanged and if it is distributed, therefore, in categories of “offer” and “demand”, we can deduct that the former (information, announcements, opinions, summons, notices, offers, suggestions, congratulations) are widely superior to the latter (requests, research) : they represent 76 % against 19 % ; the rest of the categories are neutral or reciprocal (debates, thanks, technical errors). This permits to think that the list is, above all, a means for dissemination for the issuers, who do not come so much to look for as to offer something. The list acts more as a means than as a forum ; somewhat as a journal that provides information, announcements, opinions. Maybe this is what the “lurkers” look for, that is, those who do not express themselves but prefer to receive, and are satisfied with that level of communication. This way, the issuers are so in the full sense of the word (providers) and those who receive are also so (receivers). The distribution of roles does not meet the maximum interactivity of the INTERNET myth and refers more to a pattern of the classical media. The people enrolled are subscribers that are supplied with information or virtual values, that is, potentially useful.

Categories of use of messages

If the exhaustive perception of the total messages and their vocation is desired, it is necessary to group again by categories but this time not the types (see above) but rather the apparent use, that is, what are they good for. We have thus defined 6 great categories (Graph 9).

One third of the uses are functional, that is, they fulfill a function for the user, who utilizes or may utilize them in performance of his actions. The network therefore, has an instrumental



Graph 9. Types of utilization of messages

nature. It serves for practical, utilitarian purposes in the (relative) majority of the cases. The Colombian electronic list makes available a fund of common resources which it puts in circulation. It becomes a potential vector of personal development. “If I require a bibliographic resource, instead of going to my local laboratory or to the impersonal and universal cyberspace, I am going to ask my fellow citizens”. And it is probably here, in that which is immediate and concrete, in these direct interests provided by the electronic connection, where the network acquires its reason for being and permits an individual identification to a group of a national nature.

But the electronic list is more than a simple impersonal means ; it is also a means for exchange, a form of sharing information. It is a communication space in the maximum sense of the term : individuals transmit publicly that information that they assume is of general interest. It is a common source to all, of shared referrals, probably the only one in the intellectual field for the group of expatriate scientists and for the local scientific community. Therefore it constitute the very mold of the common thought of a population that is disperse by nature. The information shared (of a general, formal or institutional type) is a means for its actors to achieve a strategic position : thus, they have available a surveillance tool on the activities in Colombia and in the network.

The electronic list is, undoubtedly, a scientific space. A good part of the information that circulate have a direct academic nature. The list is specially a multidirectional event participation platform. Therefore, it is properly used for that for which it was created and by those who chose it and maintain it for that purpose : the academy. It is a serious place of exchange of communication material.

The aspect of the forum reinforces this image : the list represents the seat of discussion and polemics. However, these never result in recriminations or violent conflicts or accusations, as it is the case frequently with other electronic lists. To the contrary, the discussions that are sometimes generated about sensitive events (French nuclear tests, Colombia’s image abroad, Gorgona Prison), are invariably circumscribed to their technical and scientific aspects. As if, notwithstanding an attraction to the sociopolitical aspects, the academy would become aware of it and would deal with the problems at different levels. Very few times, although periodically, is necessary to call on the exclusive original vocation of the network to protect it against contamination.

Finally, and as the last significant dimension, the list is a labour market mechanism. It serves to disclose information related to the offer of academic employment in an extensive,

neutral, homogenous and anonymous manner (for all, in a non differentiated manner). Therefore, it is outside the local circles and it becomes universalized. In a certain way, it constitutes the perfect reconstituted market, such as it has been imagined by the neoclassicists : access by all to the same information and at the same time, regardless of where they are. This departs from the socio-professional networks in which knowledge is restricted, not very formal, slow and localized.

The technical aspects represent a minority of the cases, in which the automatic operation of the list is not deducted by itself. In general, this operation is almost neutralized : the people enrolled do not see the technical administrator appear ; only from time to time the case occurs that a new member error reminds to all the others that the communication operation depends on exact socio-technical conditions or standards.

Semantic dispersion of the messages

900 messages have been characterized by key words, some of them with up to 10 descriptors. The exercise consisted of trying to establish a very precise qualification of the set of contents dealt with in this heterogeneous electronic communication. The result is eloquent, but can not be treated quantitatively. There are more than 1600 different key words and less than 400 are repeated at least once. This reveals a huge semantic dispersion. There is no threshold of messages connected to each other, but rather a multi-directional proliferation. Only a few descriptors stand out individually (more than twenty occurrences) : Colciencias, Colombia, National University, Caldas Network, Valle University, University of Los Andes, University of Antioquia. The large Colombian institutions appear, therefore, in first place and particularly Colciencias, institution to which the network serves as evident platform. Colombia is frequently object of discussions or information. The National University, although scarcely present in the electronic network on the part of enrolled and issuer members, is a lot more so through the contents. This means that its weight in the communication messages is higher than its physical presence, as if, unquestionable actor in the Colombian academic scene, it were object of references at a distance, without any need to take part directly. The presence of the remaining important institutions is more in accordance with their importance as issuers and receivers of the network. The Caldas Network itself is frequently object of discussions in the list. It is a reflection within the electronic ambit of the construction of constitutive associations of same ; the electronic exchanges to this respect reflect the ties woven on the field or, sometimes, they themselves constitute the weft.

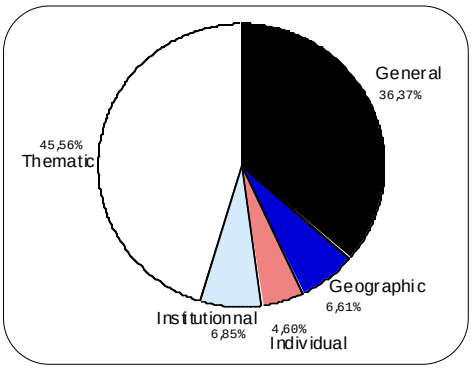
The mapping software “Leximappe” was applied to try to disclose the strong points, of semantic aggregation, thanks to the analysis of coocurrence of key words (coword analysis). These could only cover of the set of descriptors (400 which are repeated at least once over a total of 1600). It permits the appearance of clusters which means that the dispersion is not absolute. But the clusters are made without a need to represent statistically significant points of the communication set since they are made among a multitude of particular descriptors. They are some archipelagos (a debate, the repetition of announcements of one single event, an invitation to a contest) in an ocean of key words.

Scientific Work through the Electronic Network

Implied selectivity of communication

The messages intended to the group of members are a minority (36 %). Most refer to specific groups, thematic, geographic, institutional or of individuals. The list is not, therefore, a place where everything is given to everybody, but rather a space of transactions a few times particular, but frequently specific. The list is not a tribune from where it is possible to address the entire collectivity, but a grid of relations of select collective communications. A relative majority (46 % of the messages) is intended to thematic receivers (Graph 10).

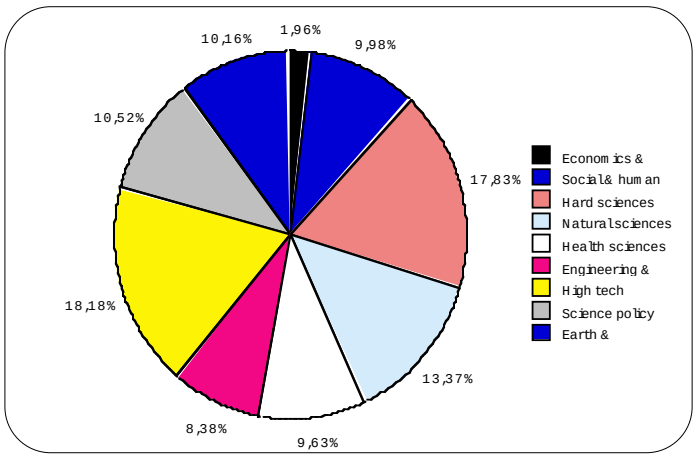
The thematic dispersion is important : there are at least 71 subjects identified (which represents an average of a little less than 8 messages/subject), some very general (disciplines) such as physics, others very specialized such as violence, for example. This confirms the results of our postal survey : the group of expatriate scientists is an heterogeneous socio-cognitive world, almost as disperse thematically than it is geographically.



Graph 10. Groups of implicit receptors

Thematic comparison between the activity of the electronic network and that of the local Colombian scientific community

The thematic groups are distributed in large disciplinary fields according to Graph 11. Among the 9 identified, 2 (new technologies and exact sciences) represent more than one third of the group. They are followed by natural sciences, political science and sciences of the land and of



Graph 11. Thematic distribution of the messages

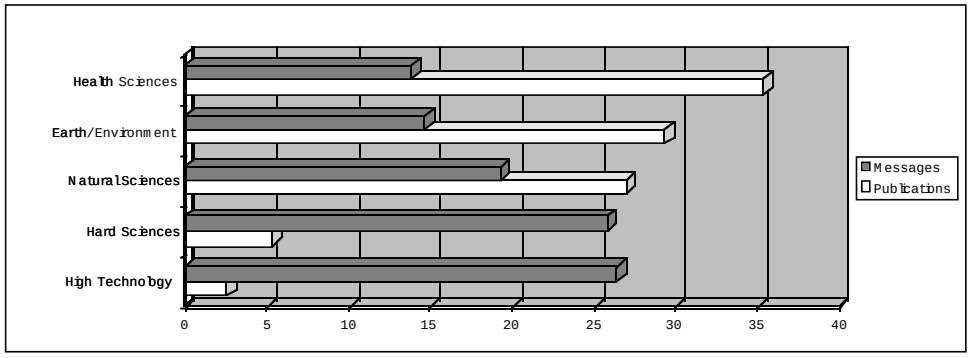
the environment, which between the three group one third of the messages. Finally, the last four categories represent less than 10 % each one (social sciences, health, engineering and traditional technologies and economics-law and administration). The latter category is, by far the weakest.

Are the thematic orientations and disciplines visible in the electronic network different or similar to those identified in the Colombian scientific community ? When comparing, field by field, the number of thematic messages to the number of publications produced in Colombia, a perfectly reverse picture appears (Graph 12).

The stronger an area within the Colombian scientific community, the weaker in the electronic network and vice versa. This would be equivalent to say that there is a certain complementation relation between the two entities.

In a previous article we had shown (Meyer, Charum, Granés, Chatelin, 95) that the disciplinary compositions of the science practiced in Colombia reflect a certain positive orientation towards local problems which research attempts to solve. But we had also made emphasis on the weakness of the "new technologies" sector which translated a structural disadvantage of the country as refers to the technological innovation and limited its socioeconomic development capacity in an open context. The marked activity of the electronic network in this sector could reveal a potential capable of repairing this weakness, with possibilities to generate innovations as of the group of expatriate scientists, thus becoming a complement of the local community in the strategic sector. In order to check this hypothesis, it is necessary to examine whether the thematic concentration "new technologies" results more from the members of the group of expatriate scientists than from those living in Colombia. But it is evident that most thematic messages of this sector issued through the network, come from researchers who live in Colombia. Would this refute the preceding hypothesis ? No, since the detailed study of these messages reveals several things, such as:

— A good number of said messages are "requests" and not offers, that is, that the Colombian institutions seek to obtain through the network information, competences or resources that they cannot find in the local environment and they believe can be acquired mobilizing the group of expatriate scientists (types of messages : bids, search for contracts, employment offers, etc.). This confirms the external orientation of the sector.
— Several messages are issued from Colombia but refer to acts performed in other countries (Chile, Spain, Mexico, etc.). The Colombian members of the network, who are interested in the new technologies, dig into new technologies abroad.
— Announcements on the subject, to perform in Colombia:
- come from non central or non dominant institution within the Colombian scientific community (frequently from provinces : Univalle, EAFIT, UNC-Medellín, UniAntioquia, UNC-Manizales or Uni-Andes in Bogotá). Our previous study showed that the Colombian scientific production was massively concentrated in Bogota in detriment of the province and strongly concentrated in the National University of this city. But the latter is absent from these domi-



Graph 12. Comparison by fields of the number (%) of Colombian scientific publications and of messages in the network electronic list (*Sources* : Pascal electronic survey)

nant areas expressed in the electronic network. On the other hand, the remaining institutions, barely visible in the Colombian production, are so here a lot more than the above mentioned;
- frequently refer to the set up of new research programs (at their start) or of education, as well as to the first national meetings or to the set up of a network or to the first bulletin, etc., thus underlying the new nature of these activities in Colombia.

Finally, what this comparison between local orientations with those of the network tends to show is a new equilibrium in course. The network comes to fill in the thematic, geographic and institutional gaps reinforcing the minor disciplinary sectors at a national level and concentrating them in those places where the activity was previously limited. It mitigates thus the discontinuities of the local scientific web. It seems as if the actors in Colombia would invert or create a new space, that of the new technologies, to develop research capabilities, with support on the group of expatriate scientists. The great traditional local actors, engaged in other scientific problems, are absent and leave vacant these spaces that the new ones endeavor to occupy. The orientation of these new actors directed abroad is equally focused in more mainstream rather than local domains but with a greater possibility to grant to the country the capability for technological innovation that it requires in the context of the open economy that it chose at the beginning of the decade.

The possible synergy between expatriate scientists and local community appears then, as one of the most promising ones. It is not born, however, from the very nature of things but from the work of the actors.

In order to materialize in an effective manner this available potential, it is necessary to create or develop the strategic associations, case by case. We have shown here that INTERNET opens in this field a fruitful perspective.

Internet y la globalización de la comunidad científica nacional Un estudio empírico

José Granés
Jean-Baptiste Meyer

Introducción

Uno de los principales dispositivos de la red Caldas “Red Colombiana de Investigadores e Ingenieros en el Exterior”, lo constituye su lista electrónica llamada R-Caldas. Esta red conecta desde Enero de 1993 a varios cientos de personas en numerosos países, que intercambian los mensajes que se dan a conocer simultáneamente a todos los miembros de la lista. La mayoría aunque no la totalidad de ellas son de nacionalidad colombiana. La lista conforma el único espacio colectivo permanente de la diáspora científica colombiana y en este sentido se convierte en un crisol importante de identidad. A tal punto esto es cierto que a menudo se confunde la red en su conjunto con su sola expresión electrónica. Hemos procedido a efectuar un estudio sistemático de la comunicación a través de la lista R-Caldas desde su origen, en Enero de 1993, hasta comienzos de 1996. Este estudio comprende más de mil mensajes analizados en una base de datos de treinta campos.

El estudio a través de esta base de datos tiene un doble objetivo. Consiste primero en aprehender este fenómeno nuevo que constituye la actividad comunicativa electrónica. En este sentido el presente estudio empírico es pionero e inédito en Colombia. El segundo objetivo de este trabajo es examinar concretamente un aporte de INTERNET al desarrollo científico, entre comunidad local y diáspora mundial. Es también un viaje documentado al corazón mismo de un mito postmoderno : la aldea planetaria. Sin pretender responder aquí a todas las preguntas formuladas por el estudio, hemos escogido abordar 4 que consideramos esenciales : ¿la lista electrónica constituye un espacio de encuentro atractivo, estable y dinámico para los miembros de la diáspora y para los investigadores en Colombia ?

¿cómo se caracterizan la emisión y la recepción de mensajes a través de esta lista ?
¿en qué consiste la comunicación y cuáles son los contenidos ?
¿en qué forma fertiliza las relaciones entre la diáspora y la comunidad local colombiana ?

Estas preguntas nos llevan a examinar los resultados de la explotación de la base en cuatro puntos sucesivos :

I- La evolución de la participación en la lista R-Caldas
II- La actividad y la intensidad emisora
III- El contenido de la comunicación
IV- El trabajo científico a través de la red electrónica

Evolución de la participación en la lista

El crecimiento exponencial

La evolución del número de personas inscritas en la lista muestra un fuerte crecimiento durante todo el período, pasando de 90 dos meses después de su creación a 551 cerca de tres años más tarde (Gráfico 1). La ligera disminución que se observa a comienzos del año 1996 (505 inscritos en abril de 1996) coincide con una reorganización de la lista electrónica efectuada por sus administradores. Esta expansión sostenida del número de inscritos es signo de un dinamismo real : cada vez más personas tienen acceso a la lista electrónica y se conectan a ella.

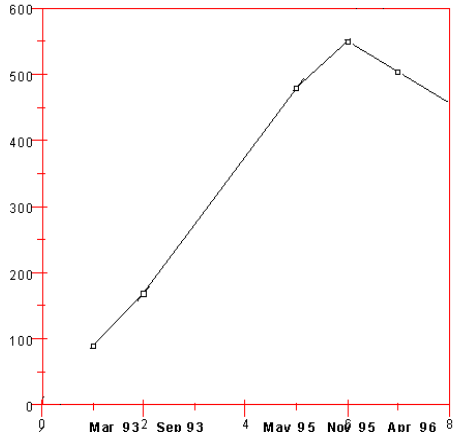


Gráfico 1. Evolución de la participación en la lista R-Caldas (Mar 93-Abr 96)
El eje vertical representa el número de inscritos

Una lista evolutiva y relativamente estable

En total, por lo menos 874 personas han estado conectadas en un momento u otro a la lista R-Caldas. Es una cifra mínima obtenida por la medición de la población en cinco censos electrónicos efectuados en diferentes momentos. Puede darse el caso que haya habido más participantes que no han sido tomados en cuenta, si entraron y salieron entre dos censos. En particular, el año de 1994 que no ha sido cubierto, puede presentar esta situación. De todas formas la cifra de 874 significa que hay idas y venidas, o al menos, entradas y salidas de la lista. El cronograma proporciona el número de inscritos que han permanecido en la lista durante caeda período.

La Gráfica 2 nos proporciona información acerca de tres aspectos que permiten caracterizar los movimientos, las transformaciones, en la composición de la lista :

- Las salidas, tasa de evasión.
- Las entradas, tasa de renovación.
- Las permanencias, tasa de estabilidad.

Estos datos indican que la lista R-Caldas es evolutiva. La población no es totalmente la misma a comienzos y a finales y hay una renovación permanente en la composición. Sin embargo, esta renovación es parcial y se nota mucha más continuidad de la participación que rupturas fuertes. En particular, la gráfica muestra una neta tendencia a la estabilización de esta población. La lista R-Caldas parece haber llegado a un umbral de desarrollo, con renovaciones y pérdidas débiles, cercano a los 500 miembros.

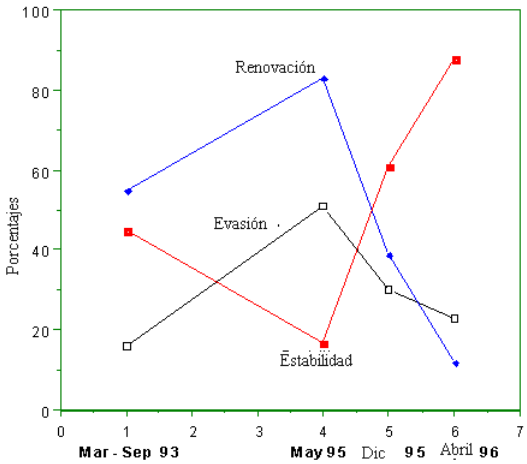


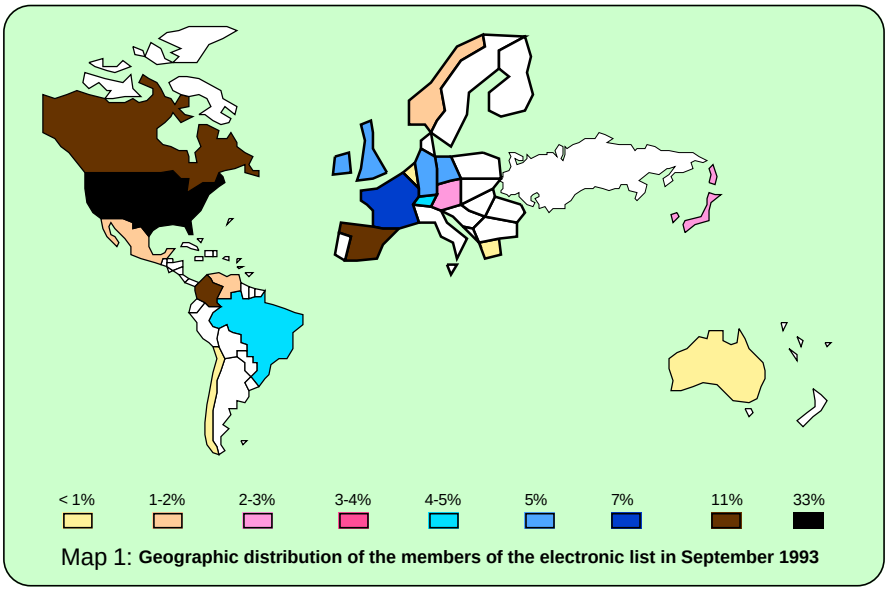
Gráfico 2. Transformaciones en la composición de la lista

En todo caso, la población de la lista electrónica no aparece como una población "volátil". La lista es efectivamente un lugar de paso al cual no se pertenece eternamente, pero donde sí se establece una vinculación pasajera que se prolonga cada vez más. Existe una cierta fidelidad a la lista. Este carácter estable, continuo, progresivo, de la composición, significa que la lista constituye un espacio comunitario, ciertamente no de una comunidad inmóvil pero sí con una tradición, orientaciones y normas de comunicación tansmitidas y avaladas por la práctica colectiva.

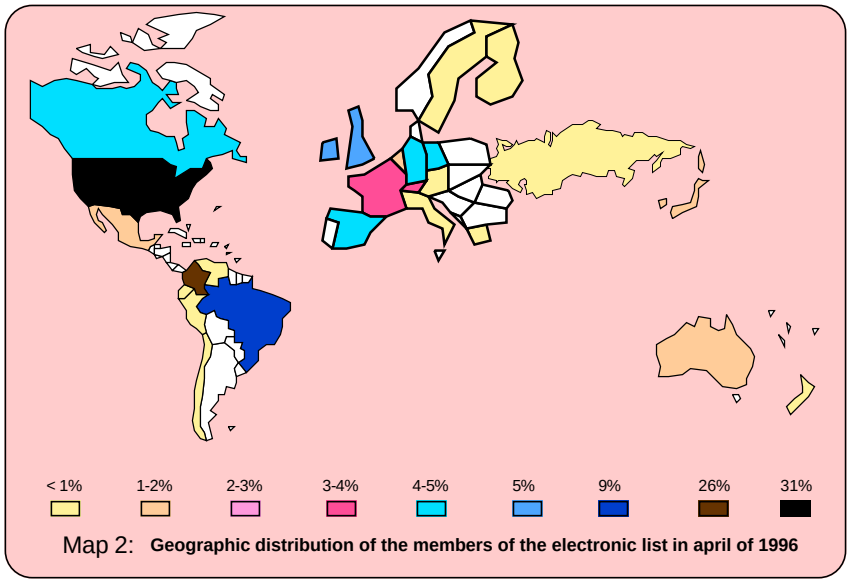
Participación creciente de la comunidad científica en Colombia

Se constata una evolución geográfica en la composición de los participantes de la lista. Inicialmente muy fuertemente concentrada en América del Norte (USA y Canadá) y Europa (Francia, España), la participación se diversifica (pasa de 13 países en marzo de 1993 a 26 tres años más tarde) y América Latina pasa a ocupar un lugar mucho más importante (Colombia y Brasil principalmente) convirtiéndose en la región con mayor número de participantes (ver Mapas 1 y 2).

Aquí es posible constatar dos fenómenos :
a) el desarrollo de las redes electrónicas en los países en desarrollo, en donde se encuentra un alto número de efectivo colombianos (países latinoamericanos en su mayoría) ;



Map 1: **Geographic distribution of the members of the electronic list in September 1993**



Map 2: **Geographic distribution of the members of the electronic list in april of 1996**

b) la internalización (endogenización) en Colombia de la Red Caldas ; INTERNET abrió indiscutiblemente la posibilidad a los residentes de comunicarse con sus pares expatriados y aprovecharon la oportunidad. Colombia es ahora el segundo país en número de inscritos (más de un cuarto del total), seguido de cerca por Estados Unidos y muy por delante de los demás países. Es también el país que registra, tanto en porcentaje como en cifra absoluta, el más fuerte crecimiento de conexiones a la red, lo que prueba una difusión interna de la red y quizás el final de una red diaspórica excéntrica.

Igualmente es posible notar un cierto estancamiento y aún a veces una ligera disminución de la participación en valor absoluto de ciertos países : España, Francia, México, Canadá, Austria y aún los Estados Unidos, aunque en menor medida. ¿Será esto el presagio de una saturación del potencial de comunicación en estas zonas o el hastío de los participantes en estos países ? Parece significativo que estos países sean con frecuencia aquellos que primero se conectaron y han renovado poco sus participantes... También es necesario considerar que hay listas disidentes o locales que existen internamente...

La dispersión geográfica e institucional de los miembros de la lista

La red es tanto geográfica como institucionalmente dispersa. Pocos incritos en la lista tienen una dirección electrónica cercana. La mayoría de los miembros están “aislados”, en algún momento del período. Para ellos la red crea por tanto una proximidad, que sin ella no existiría. Los vínculos sociales físicos no parecen tener un gran impacto sobre la red electrónica. Las personas que se han inscrito lo han hecho sin comunidad local, salvo quizás dentro de Colombia misma.

Sin embargo, se nota una concentración creciente de efectivos : se ha pasado de cerca de - aislados al comienzo a casi la mitad de no aislados al final. El número de instituciones disminuye entre mayo de 1995 y abril de 1996, mientras que el número de participantes aumenta. El fenómeno está relacionado con la “colombianización” de la lista : las grandes instituciones colombianas concentran un número importante de miembros (Univalle, Colciencias, Uniandes, UNC, Javeriana). Además están masivamente localizadas en Bogotá. Si se retiraran estas instituciones colombianas, la lista quedaría extremadamente dispersa con algunas pequeñas concentraciones locales como en Brasil, por ejemplo, pero que no superan 5 personas inscritas de la misma institución. Por lo tanto la diáspora es dispersa, mientras que la comunidad electrónica colombiana se encuentra aglutinada en algunas instituciones. De un origen nebuloso, la red pasa progresivamente a adquirir la forma de un sistema centrado, en Colombia.

Actividad e intensidad emisoras

Crecimiento masivo del número de emisiones

La cantidad de emisión de mensajes se dobla cada año (Gráfico 3). Lo anterior se traduce en una densificación progresiva de la comunicación. En 1994 los días de emisión representaban 39 % de los días del año, con un promedio de 2.2 mensajes por día de emisión. En 1995 los días del año que constituyen días de emisión son el 56 %, con un promedio de 3 mensajes diarios.

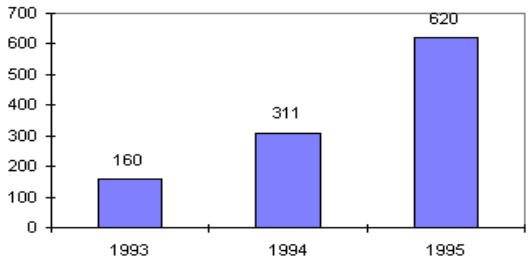


Gráfico 3. Número de mensajes por año

En 1994, la mitad de los mensajes posee una frecuencia de emisión de 1 por día, y la otra mitad se escalona entre 2 y 10 por día, con una débil cantidad de días de fuerte emisión (> 3 mensajes/día). Esto significa que hay una diseminación comunicativa muy poco densa, ya que la mayoría de los mensajes se emite a razón de uno, dos o tres por día. La evolución es muy sensible en 1995 : hay menos días en los cuales se emite solamente un mensaje y los días de emisión con un mínimo de dos mensajes (máximo doce) son dos veces más numerosos. La mayoría de los mensajes se emite a razón de 3, 4, 5 y 6 por día. Esto significa una fuerte densificación de la emisión y una intensificación notable de la comunicación. Lo anterior modifica la recepción : se reciben más mensajes, más a menudo y cada mensaje viene generalmente acompañado por otros.

Sin embargo, si se compara esta actividad emisora con la de otras listas electrónicas a veces menos numerosas en cuanto al número de inscritos, es posible constatar que es cuantitativamente débil y de una intensidad relativamente modesta. Ello se debe al carácter de comunicación de la lista, tal como lo demostraremos más adelante.

Actividad emisora polarizada

La actividad emisora es a la vez concentrada y dispersa. Un número importante de instituciones y de individuos diferentes emiten en un momento u otro, pero la mayoría de las emisiones se concentra alrededor de algunas de dichas instituciones o de algunos de dichos individuos.

Personas emisoras

Es posible observar que la población de la lista está constituida en su mayoría por "*lurkers*" - Inscritos "furtivos" (así llamados por los responsables de otra lista electrónica, de sociología de las ciencias)- que no emiten nunca. Más o menos dos inscritos de tres se encuentran en este caso (Gráfico 4).

Además, entre quienes emiten, la parte de los emisores excepcionales representa igualmente cerca de 2/3. Quienes emiten ocasionalmente representan un poco menos de 10 % y los emisores significativos escasamente llegan a 5 %. La intensidad de la actividad comunicativa, o por lo menos emisora, es inversamente proporcional al número de emisores. Este fenómeno de polarización no es sorprendente y parece corresponder a una práctica electrónica corriente.

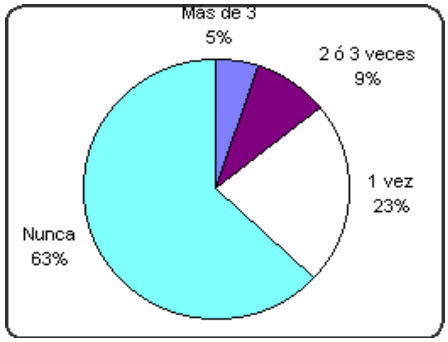


Gráfico 4. Proporción de remitentes por frecuencia de emisiones

Si se considera la parte de la comunicación electrónica atribuíble a las diferentes categorías de emisores, se constata que más de 2/3 de los mensajes emitidos (68 %) provienen de los emisores ocasionales (de 3 a 9 mensajes durante el período), de los emisores frecuentes (de 13 a 41 mensajes durante el período), y de la coordinadora de Colciencias (232 mensajes durante el período) (Gráfico 5). Por otra parte, las categorías emisores excepcionales (1 mensaje durante el período) y casuales (2 mensajes durante el período) representan menos de 1/3 del total de la comunicación electrónica.

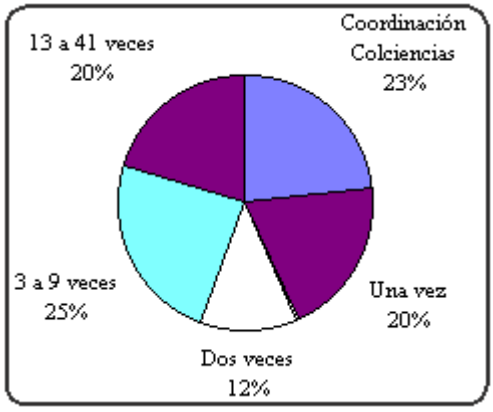


Gráfico 5. Proporción de mensajes por categoría de remitentes

¿Qué significan estas cifras ? Que el espacio comunicacional es conocido y está señalizado. Ha sido marcado por personas, identificadas. Cuando una persona emite más de tres veces, es identificada por los demás y tiene la oportunidad de ser reconocida, las veces siguientes. La comunicación electrónica no es anónima y el sentido no es aleatorio, el contenido se construye a menudo con un cierto presentimiento de lo que pueden ser las reacciones. La interpretación del sentido se hace en función de estos puntos de referencia. La paradoja es que el resto es un hueco negro y sin embargo constituye la mayoría de quienes reciben y por tanto también de quienes interpretan.

Instituciones emisoras

Hay 165 instituciones emisoras.

78 emiten una vez (47 %),
29 emiten 2 veces (18 %),
40 emiten entre 3 y 10 veces (24 %),
18 emiten más de 10 veces (11 %).

La dispersión institucional es menos fuerte que la dispersión individual pero, sin embargo, es muy significativa. Y la polarización es evidente : el 11 % de las instituciones emiten 2/3 del conjunto de los mensajes.

Un fenómeno interesante : si bien es cierto que ninguno de los grandes emisores individuales está en Colombia (exceptuando las coordinadoras de Colciencias), tambien es un hecho que 5 instituciones colombianas se encuentran entre las 17 grandes emisoras, y representan el 35 % de las comunicaciones emitidas por esta categoría (eliminando a Colciencias). Esto significa una personalización mínima de la comunicación en Colombia y una repartición sobre un amplio número de personas. Encontramos nuevamente las grandes instituciones inscritas (Univalle, Uniandes a la cabeza, los “activos electrónicos”) con un desdibujamiento de dos otros grandes de Bogotá, UNC y sobre todo Javeriana en beneficio de los emisores de provincia (Eafit y Uniantioquia), dinámicos aunque poco numerosos.

Colombia : centro emisor

Hay 28 países emisores (Gráfico 6).

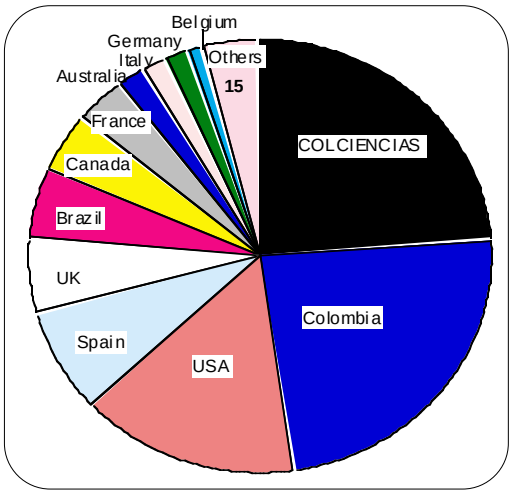


Gráfico 6. Emisiones por país

La emisión es más o menos dispersa o concentrada según los países. Muy concentrada en Suiza (20 por institución en promedio), en Italia (8) y en España (7,5) y lo es menos en Colombia (un poco menos de 6 si se excluye la coordinadora de Colciencias) y en Canadá, Brasil, Bélgica y Francia (entre 4 y 6) ; en los Estados Unidos está poco concentrada (3) y en Alemania muy dispersa (1,2).

Colombia tiene una tasa de emisión más alta que el promedio de inscritos, así como Australia, y a la inversa de los Estados Unidos. Los demás países son más o menos equivalentes : su porcentaje de emisión corresponde, en gran medida, al de su número de inscritos. Estas cifras permiten pensar que los participantes “furtivos” son menos numerosos en Colombia ; los de Suiza, por el contrario, son muy numerosos ; se ve, pues, un fuerte contraste según los países. Podría ser que la conexión a la lista se haga por motivos diferentes. según el lugar de residencia. En Colombia, por ejemplo, las personas se conectan tanto para transmitir informaciones como para recibirlas, mientras que en la diáspora la Red sirve más como una herramienta de información constante acerca de las actividades académicas del país y las de los compatriotas en el exterior. Es una postura que denominamos : “vigilia estratégica individual”.

El contenido de la comunicación

Comunicación académica sostenida y de carácter nacional

Idiomas de comunicación

895 (87 %) mensajes son en español
39 (4 %) en español e inglés
91 (9 %) en inglés
1 en español y portugués.

La lengua dominante es ampliamente el español. El inglés no es utilizado, conjuntamente o solo, sino en 13 % de los casos. La lista es, por lo tanto, eminentemente latina e hispanófona ; aún si se trata de una lista mundial y científica, no adopta ni la lengua internacional ni la de la ciencia. Los mensajes en inglés son, con frecuencia, importaciones : texto del exterior, anuncios de acontecimientos, de empleos, de becas, etc. Esta lengua es implícitamente conocida puesto que hay más en inglés que en español-inglés pero no es la de la comunicación, así como tampoco lo son el francés y el portugués a pesar del hecho de que algunos miembros de la lista no son colombianos.

Longitud de los mensajes

Podemos repartir el conjunto de los mensajes según categorías definidas por su longitud : menos de media página ; son mensajes cortos que suministran una información breve, una reacción espontánea, un intercambio de contenido poco desarrollado ; entre media página y una página ;

- son mensajes más elaborados, el equivalente a una carta, que demandan algunos minutos para su redacción ; de una a dos páginas ; el equivalente a una larga carta, un intercambio preparado, o al menos al cual se le dedica un cierto tiempo de expresión ;
- de dos a cinco páginas ; se trata de una comunicación muy desarrollada, con un contenido sustancial, que requiere una elaboración consistente por parte del redactor y un tiempo de lectura apreciable ; de cinco a diez páginas ; es una información muy elaborada, generalmente preparada con anticipación y difundida en un segundo tiempo ; el contenido es evidentemente muy sustancioso ;
- más de diez páginas : casos excepcionales, transcripción de artículos largos.

La gráfica 7 indica que la mayoría absoluta de los mensajes tiene una longitud comprendida entre 1 y 5 páginas. Esto revela una comunicación evidentemente elaborada. La mayoría de los mensajes con frecuencia son trabajados y preparados con antelación. Este es seguramente el caso de todos aquellos que sobrepasan 2 páginas y que son envío de textos “importados”. Provienen, en efecto, bien sea de otras listas electrónicas o del ámbito externo a la “electrónica” y son pasados a la red que actúa así como una plataforma giratoria de información pre-elaborada. En el caso de mensajes entre una y dos páginas, puede tratarse de textos pre-elaborados, pero también de textos escritos directamente para la red. Sin embargo, en este último caso, se trata de un texto construido, estructurado, que remite a un trabajo de comunicación elaborado. En promedio, la red contiene por tanto una información sustancial en término de contenidos que ha sido forjada por un trabajo previo, efectuado en el curso de la conexión o con anterioridad a la misma. Pero la red es también un lugar de vida comunicativa espontánea e inmediata. La parte correspondiente a los mensajes cortos no es despreciable, aunque sea minoritaria.

La lista conlleva por lo tanto los dos aspectos : en primer lugar, constituye un espacio de intercambio de información elaborada, que representa el trabajo de actores que puede recuperarse mediante la circulación electrónica ; pero es también un lugar de expresión inmediata, de un compartir instantáneo con intercambios cortos. Otras listas INTERNET están mucho más cen-

tradas en los mensajes cortos, en un foro de intercambios entre múltiples participantes, como si se tratara de una discusión alrededor de una mesa redonda. Este no es más que un aspecto de la lista R-Caldas que se parece cada vez más, en su conjunto, a un boletín de informaciones académicas, una *Newsletter* en la cual los contenidos raramente se desarrollan como en un coloquio o en una revista científica, pero sí son suficientes para alimentar la labor personal de los receptores.

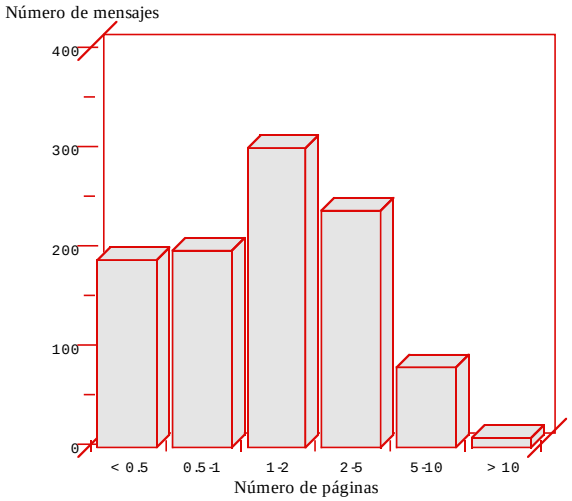


Gráfico 7. Tamaño de los mensajes

Uso instrumental mucho más que social

Las grandes categorías de mensajes

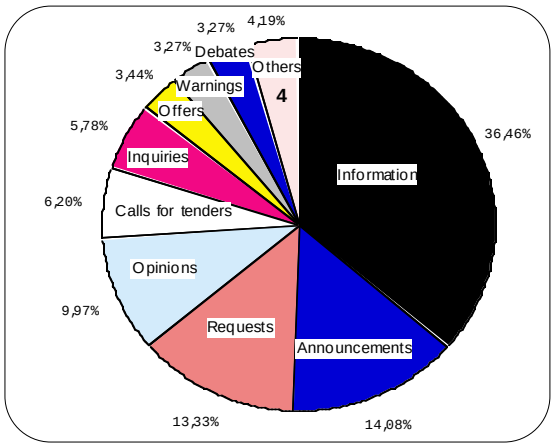


Gráfico 8. Tipos de mensajes

Si se considera la lista como un lugar en el cual se efectúan diferentes transacciones, en el que se intercambian comunicaciones y si se reparte, por tanto, en categorías de “oferta” y “demanda”, podemos deducir que las primeras (información, anuncios, opiniones, convocatorias, avisos, ofertas, sugerencias, felicitaciones) son ampliamente superiores a las segundas (solicitudes, investigaciones) : representan 76 % contra 19 % ; las demás categorías son neutras o recíprocas (debates, agradecimientos, errores técnicos). Esto permite pensar que la lista es, ante todo, un medio de difusión para los emisores, que no vienen tanto a buscar como a ofrecer algo. La lista actúa más como un medio que como un foro ; un poco como un diario que suministra informaciones, anuncios, opiniones. Quizás esto es lo que buscan los participantes

"furtivos", es decir aquellos que no se expresan, sino que prefieren recibir, y se satisfacen con este nivel de comunicación. En esta forma, los emisores lo son en el pleno sentido del término (oferentes) y los receptores lo son igualmente (recibidores). Repartición de roles que va al encuentro de la interactividad máxima del mito INTERNET y tiene más relación con los medios clásicos. Los inscritos son abonados que se surten de información o de valores virtuales, es decir, potencialmente útiles.

Categorías de uso de los mensajes

Si se quiere percibir la totalidad de los mensajes y su vocación en forma exhaustiva, es necesario reagrupar por categorías ya no por tipos (ver anteriormente) sino más bien por el uso aparente, es decir según la utilidad. Hemos definido así 6 grandes categorías (Gráfico 9) :

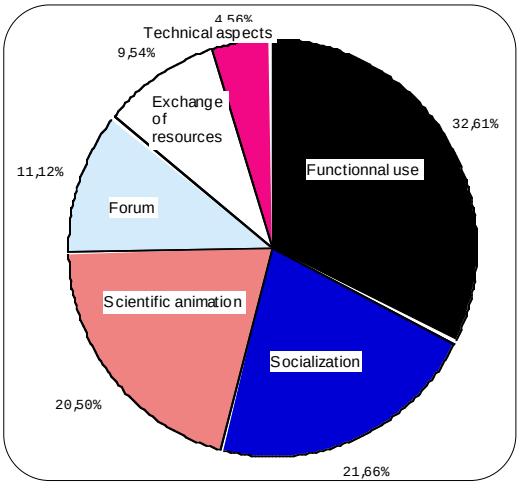


Gráfico 9. Tipos de uso de los mensajes

Un tercio de los usos son funcionales, es decir que cumplen una función para el usuario, quien los utiliza o puede utilizarlos en desarrollo de sus acciones. La red tiene por tanto un carácter instrumental. Sirve para fines prácticos, utilitarios, en la mayoría (relativa) de los casos. La lista electrónica colombiana pone a disposición un fondo de recursos comunes que hace circular. Se convierte en vector potencial del desarrollo personal... "Si requiero un recurso bibliográfico, en lugar de dirigirme a mi laboratorio local o al ciber-espacio impersonal y universal, voy a preguntarle a mis compatriotas..." Y es seguramente aquí, en lo concreto inmediato, en estos intereses directos que suministra la conexión electrónica, donde la red adquiere su razón de ser y permite una identificación individual a un colectivo de carácter nacional.

Pero la lista electrónica es más que un simple medio impersonal ; es también un medio de intercambio, una forma de compartir información. Es un espacio de comunicación en el lato sentido del término : los individuos transmiten públicamente aquellas informaciones que suponen son de interés general. Es una fuente común a todos, de referentes compartidos, probablemente la única en el campo intelectual para la diáspora colombiana y para la comunidad científica local. Por lo tanto constituye el crisol mismo del pensamiento común de una población por naturaleza dispersa. Las informaciones compartidas (de tipo general, formal o institucional) son un medio para que sus actores puedan lograr una posición estratégica : disponen así de una herramienta de observación de las actividades en Colombia y en la red.

La lista electrónica es, indiscutiblemente, un espacio científico. Una buena parte de las informaciones que circulan revisten un carácter académico directo. La lista es especialmente una plataforma de participación multidireccional de acontecimientos. Por lo tanto, está bien utilizada para lo que fue creada y por quienes la escogieron y la mantienen para tal fin : la academia. Es un lugar serio de intercambio de material de comunicación.

El aspecto de foro refuerza esta imagen : la lista constituye la sede de discusiones y polémicas. Sin embargo, éstas no derivan nunca en recriminaciones o conflictos violentos o denuncias, como sí sucede con frecuencia con otras listas electrónicas. Por el contrario, las discusiones que se generan a veces sobre acontecimientos sensibles (pruebas nucleares francesas, imagen de Colombia en el exterior, prisión de Gorgona), quedan invariablemente circunscritas a sus aspectos técnicos y científicos. Como si, a pesar de un atractivo hacia lo socio-político, la academia tomara conciencia y tratara los problemas a niveles diferentes. Muy pocas veces, aunque si ocalsionelmente, es necesario hacer un llamado a la vocación original exclusiva de la red para protegerla de contaminación.

Finalmente y como última dimensión significativa, la lista es un mecanismo de mercado. Sirve para difundir información relativa a la oferta de empleos académicos en forma extensa, neutra, homogénea y anónima (para todos, de manera no diferenciada). Por tanto queda fuera del ámbito de las roscas locales y se universaliza. En cierta forma, constituye el mercado perfecto reconstituido, tal como lo han imaginado los neoclásicos : acceso de todos a la misma información y en el mismo momento, independientemente de dónde se encuentren. Esto se sale de las redes socio-profesionales en las cuales el conocimiento es restringido, poco formal, lento y localizado.

Los mensajes que tratan sobre aspectos técnicos representan representan una minoría de los casos, en los cuales el funcionamiento automático de la lista presenta dificultades. En forma general, este funcionamiento es casi naturalizado : los inscritos no ven aparecer al administrador técnico ; solamente de cuando en cuando se da el caso que un debutante recuerde que el funcionamiento depende de condiciones o normas socio-técnicas precisas.

Dispersión semántica de los mensajes

900 mensajes se han caracterizado por palabras claves, algunas de ellas hasta con 10 descriptores. El ejercicio consistió en tratar de establecer una calificación muy fina del conjunto de los contenidos tratados en esta comunicación electrónica heterogénea. El resultado es elocuente, pero no puede tratarse cuantitativamente. Hay más de 1600 palabras clave distintas y menos de 400 se repiten por lo menos una vez. Esto revela una dispersión semántica enorme. No hay un umbral de mensajes relacionados entre sí, sino más bien una proliferación multidireccional. Tan sólo algunos descriptores se destacan individualmente (más de veinte ocurrencias) : Colciencias, Colombia, Universidad Nacional, Red Caldas, Universidades del Valle, de los Andes, de Antioquia... Las grandes instituciones colombianas aparecen por tanto en primer lugar y principalmente Colciencias institución a la cual la red sirve de plataforma evidente. Colombia es frecuentemente objeto de discusiones o de informaciones. La Universidad Nacional, aunque poco presente en la red electrónica por parte de sus miembros inscritos y emisores, lo está mucho más a través de los contenidos. Esto significa que su peso en los mensajes de comunicación es superior a su presencia física, como si, actor incuestionable en la escena académica colombiana, fuera objeto de referencias a distancia sin necesidad de que intervenga directamente. La presencia de las demás instituciones importantes está más acorde con su importancia como emisores y receptores en la red. La misma red Caldas es frecuentemente objeto de discusiones en la lista. Se trata de una “reflexión” al interior del recinto electrónico, de la construcción de asociaciones constitutivas del mismo ; los intercambios electrónicos a este respecto reflejan los vínculos tejidos sobre el terreno o, algunas veces, constituyen la trama.

El programa de cartografía de los contenidos “Leximappe” se aplicó para tratar de develar los puntos fuertes, de agregación semántica, gracias al análisis de concurrencias de palabras claves. Estas no podían abarcar sino - del conjunto de los descriptores, (400 que se repiten por lo menos una vez sobre un total de 1600). Permite efectivamente hacer aparecer aglomeraciones (*clusters)* lo que significa que la dispersión no es absoluta. Pero las aglomeraciones se

efectúan sin necesidad de representar puntos estadísticamente muy significativos del conjunto de la comunicación puesto que se realizan entre una multitud de descriptores particulares. Son algunos archipiélagos (un debate, la repetición de anuncios de un acontecimiento, una convocatoria a un concurso) en un océano de palabras claves...

El trabajo científico a través de la red electrónica

Selectividad implícita de la comunicación

Los mensajes destinados al conjunto de los miembros son una minoría (36%). La mayoría se refiere a grupos específicos, temáticos, geográficos, institucionales o de individuos. La lista no es por tanto un lugar en donde todo se da a todos, sino más bien un espacio de transacciones pocas veces particulares, pero a menudo específicas. La lista no es una tribuna desde donde es posible dirigirse a toda la colectividad, sino una cuadrícula de relaciones de comunicaciones colectivas selectas. Una mayoría relativa (46% de los mensajes) está destinada a receptores temáticos.

La dispersión temática es importante : hay por lo menos 71 temas identificados (lo que representa un promedio de un poco menos de 8 mensajes/tema), algunos muy generales (disciplinas), como la física, otros muy especializados como la violencia, por ejemplo. Esto confirma los resultados de nuestra encuesta postal : la diáspora es un mundo socio-cognitivo inconexo, menos disperso temáticamente que geográficamente.

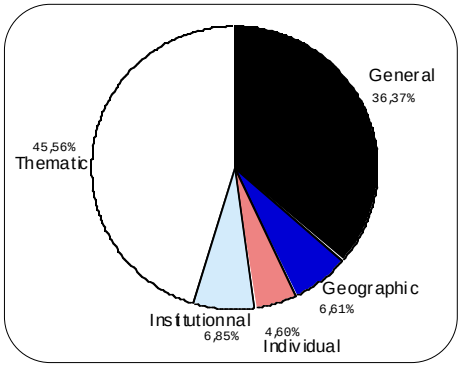


Gráfico 10. Grupos de receptores implícitos

Comparación temática entre la actividad de la red electrónica y la de la comunidad científica colombiana local

Los grupos temáticos se reparten en grandes campos disciplinarios según la Gráfica 11, entre los cuales los 9 identificados representan más de un tercio del conjunto. Las nuevas tecnologías están seguidas por las ciencias naturales, la ciencia política y las ciencias de la tierra y del medio ambiente, que entre las tres agrupan un tercio de los mensajes. Finalmente, las cuatro últimas categorías representan menos de 10% cada una (ciencias sociales, salud, ingenierías y tecnologías tradicionales y economía-derecho y administración). Esta última categoría es, por mucho, la más débil.

¿Son las orientaciones temáticas y las disciplinas visibles en la red electrónica distintas o similares a las identificadas en la comunidad científica colombiana? Si se compara campo por campo el número de mensajes temáticos con el número de publicaciones producidas en Colombia, se obtiene una imagen diametralmente opuesta (Gráfico 12). Las temáticas fuertes dentro de la comunidad científica colombiana son débiles en la red electrónica e inversamente. Esto equivaldría a decir que hay una cierta relación de complementariedad entre las dos entidades.

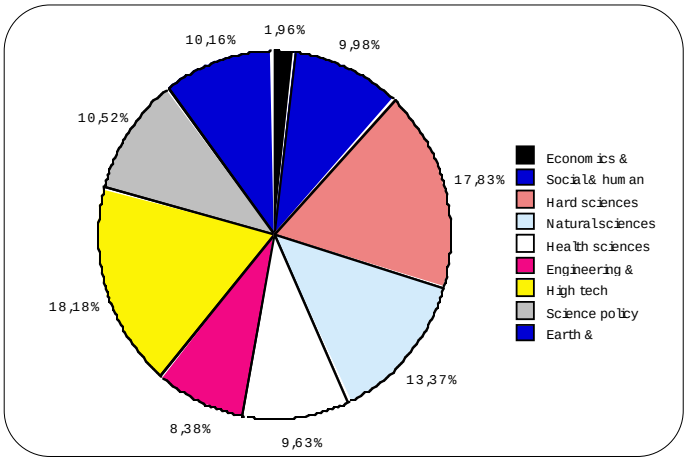


Gráfico 11. Grupos de receptores implícitos

En un artículo anterior habíamos demostrado (Meyer, Charum, Granés, Chatelin ; 95) que los compuestos disciplinarios de la ciencia que se practica en Colombia reflejan una cierta orientación positiva hacia los problemas locales que la investigación pretende resolver. Pero también habíamos hecho énfasis sobre la debilidad del sector “nuevas tecnologías” que traducía una desventaja estructural del país en cuanto a innovación tecnológica y limitaba su capacidad de desarrollo socio-económico en un contexto abierto. La pronunciada actividad de la red electrónica en este sector podría revelar un potencial capaz de remediar esta debilidad, con posibilidades de generar innovaciones a partir de la diáspora, convirtiéndose así en un complemento de la comunidad local en un sector estratégico. Para verificar esta hipótesis, es necesario examinar si la concentración temática “nuevas tecnologías” se desprende más de los miembros de la diáspora que de los de Colombia. Pero es evidente que la mayoría de los mensajes temáticos de este sector emitidos a través de la red, provienen en su gran mayoría de investigadores radicados en Colombia. ¿Vendría esto a refutar la hipótesis precedente ? No, puesto que el estudio detallado de estos mensajes revela varias cosas :

- un buen número de dichos mensajes son “solicitudes” y no ofertas, es decir, que las instituciones colombianas buscan a través de la red obtener informaciones, competencias o recursos que no pueden encontrar en el medio local y piensan poder adquirirlos movilizando la diáspora (tipos de mensajes : licitaciones, búsqueda de contactos, ofertas de puestos, etc.). Esto confirma la orientación externa del sector ;

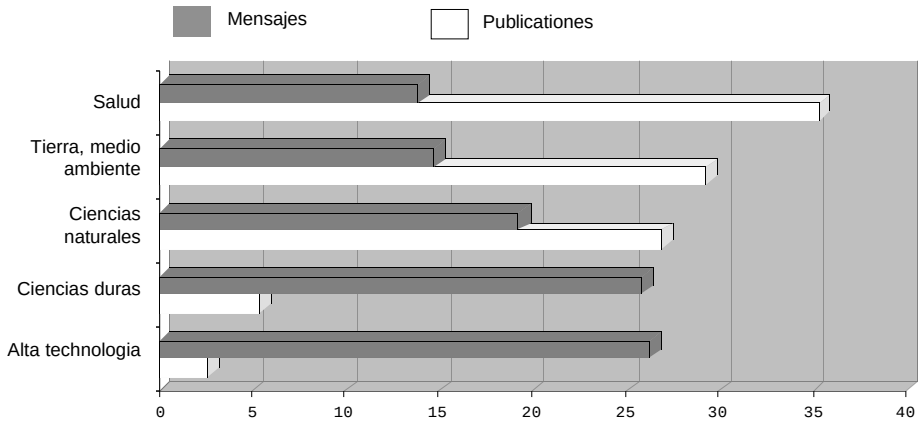


Gráfico 12. Comparación por grandes disciplinas de la candidad (%) de publicationes científicas de Colombia y de mensajes en la lista de la red electrónica
(*Fuentes :* Pascal, encuensta electrónica)

- varios mensajes son emitidos desde Colombia pero se refieren a actos efectuados en otros países (Chile, España, México, etc.). Los miembros colombianos de la red interesados en las nuevas tecnologías excavan ampliamente al exterior del país ;
- anuncios sobre el tema, para realizar en Colombia : emanan de instituciones no centrales o no dominantes dentro de la comunidad científica colombiana (de provincia frecuentemente : Univalle. EAFIT, UNC-Medellín, Uni-Antioquia, UNC-Manizales o Uni-Andes en Bogotá). Nuestro estudio anterior demostraba que la producción científica colombiana se encontraba masivamente concentrada en Bogotá en menoscabo de la provincia y fuertemente concentrada en la Universidad Nacional de esta ciudad. Pero esta última está ausente de estas temáticas dominantes expresadas en la red electrónica. Por otra parte, las demás instituciones, poco visibles en las producción colombiana, lo están aquí mucho más que la anterior ;
- se refieren a menudo al montaje de nuevos programas de investigación (en sus inicios) o de formación, así como a los primeros encuentros nacionales o al montaje de una red o al primer boletín, etc... subrayando así el carácter novedoso de estas actividades en Colombia.

En definitiva, lo que pretende demostrar esta comparación entre temáticas locales y temáticas de la red es un nuevo equilibrio en curso. La red viene a llenar las lagunas temáticas, geográficas e institucionales reforzando los sectores disciplinarios menores a escala nacional y concentrándolos en aquellos lugares en donde la actividad anteriormente era limitada. Mitiga así las discontinuidades del tejido científico local. Parece como si los actores en Colombia invirtieran o crearan un nuevo espacio, el de las nuevas tecnologías, para desarrollar capacidades de investigación, apoyándose en la diáspora. Los grandes actores tradicionales locales, dedicados a otras problemáticas científicas, están ausentes y dejan vacantes estos espacios que los nuevos se esfuerzan por ocupar. La orientación de estos nuevos actores volcada hacia el exterior del país se enfoca igualmente en dominios más "*mainstream*" que locales pero con mayor posibilidad de otorgar al país la capacidad de innovación tecnológica que requiere en el contexto de la economía abierta que escogió a comienzos del decenio.

La sinergia posible entre diáspora y comunidad local aparece pues, como una de las más prometedoras. No nace, sin embargo, de la naturaleza misma de las cosas, sino del trabajo de los actores.

Para materializar en forma efectiva este potencial disponible, es necesario crear o desarrollar las asociaciones estratégicas, caso por caso. Hemos demostrado aquí que INTERNET abre en este campo una perspectiva extremadamente fecunda.

Internet et la globalisation de la communauté scientifique nationale : une étude empirique

Jean-Baptiste Meyer
José Granés

Introduction

Un des dispositifs majeurs du réseau Caldas, « réseau colombien des chercheurs et ingénieurs à l'extérieur », est constitué par sa liste électronique, nommée R-Caldas. Elle connecte depuis janvier 1993 plusieurs centaines de personnes dans un grand nombre de pays, qui échangent des messages publiés à l'ensemble. La plupart mais non la totalité d'entre elles sont de nationalité colombienne. La liste est le seul espace collectif permanent de la diaspora scientifique colombienne et à ce titre le creuset de son identité ; à tel point que souvent, on confond le réseau dans son ensemble avec sa seule expression électronique. Nous avons procédé à une étude systématique de la communication à travers la liste R-Caldas, depuis son origine en janvier 1993 jusqu'au début de 1996. Cela représente plus de 1 000 messages analysés en une base de données de 30 champs caractérisant chacun d'entre eux.

A travers cette base de données, l'objectif de notre étude est double. Il consiste d'abord à saisir ce phénomène nouveau que constitue l'activité communicationnelle électronique. En ce sens, la présente étude empirique est pionnière et inédite. Le second but de ce travail est d'examiner concrètement un apport d'Internet au développement scientifique, entre communauté locale et diaspora mondiale. C'est donc aussi un voyage documenté au coeur d'un mythe post-moderne : le village planétaire. Sans prétendre répondre ici à toutes les questions soulevées par cette étude, nous avons choisi d'en aborder 4, essentielles :

- la liste électronique est-elle un espace de rencontre attractif, stable et dynamique pour les membres de la diaspora et pour les chercheurs en Colombie ?
- comment se caractérisent l'émission et la réception de messages au travers de cette liste ?
- en quoi consiste la communication, quels en sont les contenus ?
- comment fertilise-t-elle les rapports entre la diaspora et la communauté locale colombienne ?

Ces questions nous amènent à examiner les résultats de l'exploitation de la base en quatre points successifs :

I - L'évolution de la participation à liste R-Caldas.
II - L'activité et l'intensité émettrice.
III - Le contenu de la communication.
IV - Le travail scientifique à travers le réseau électronique.

Évolution de la participation à la liste

Un accroissement exponentiel

L'évolution du nombre de personnes inscrites à la liste montre un très fort accroissement sur toute la période, passant de 90 deux mois après sa création à 551 près de trois ans plus tard (fig. 1). La diminution légère en début d'année 1996 (505 inscrits en avril 96) coïncide avec une réorganisation de la liste électronique par ses administrateurs. Cette expansion soutenue du nombre d'inscrits est signe d'un dynamisme certain : de plus en plus de gens ont accès à la liste électronique et s'y connecte.

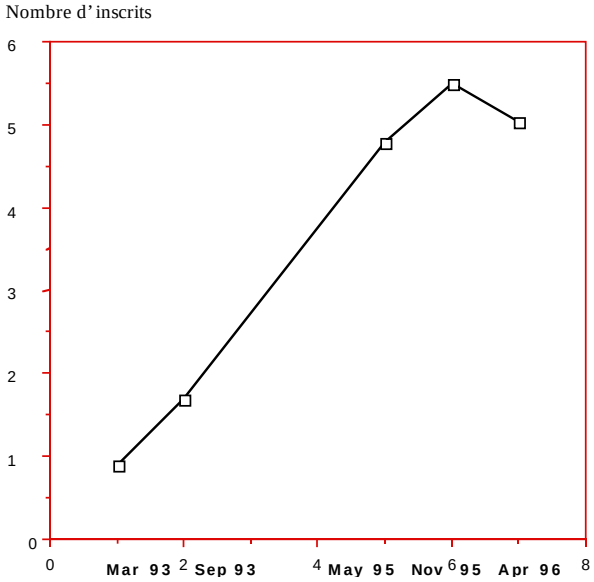


Figure 1. Évolution de la participation au réseau Caldas (mars 93-avril 96)

Une liste évolutive et relativement stable

En tout, ce ne sont pas moins de 874 personnes qui ont été connectées à un moment ou à un autre à la liste R-Caldas. C'est un chiffre minimum obtenu par la mesure de la population en 5 recensements électroniques effectués à différents moments. Il se peut donc qu'il y ait eu plus de participants, non pris en compte s'ils sont entrés et sorties entre deux recensements. En particulier, l'année 1994, non couverte, peut présenter ce cas de figure. Quoiqu'il en soit le chiffre de 874 signifie qu'il y a des allées et venues ou pour le moins des entrées et des sorties de la liste.

La figure 2 nous fournit une information sur trois aspects pour caractériser les mouvements, les transformations dans la composition de la liste :

- les sorties, taux d'évasion
- les entrées, taux de renouvellement
- les permanences, taux de stabilité

Ce qu'indiquent ces données c'est que la liste R-Caldas est évolutive. La population n'est pas complètement la même au début qu'à la fin et il y a un renouvellement permanent de la composition. Cependant, ce renouvellement est partiel et on note une continuité de la participation beaucoup plus que des ruptures fortes. En particulier le graphique montre une nette tendance à la stabilisation de cette population. La liste R-Caldas semble avoir atteint un seuil de développement, avec renouvellement et perte faibles, autour de 500 membres.

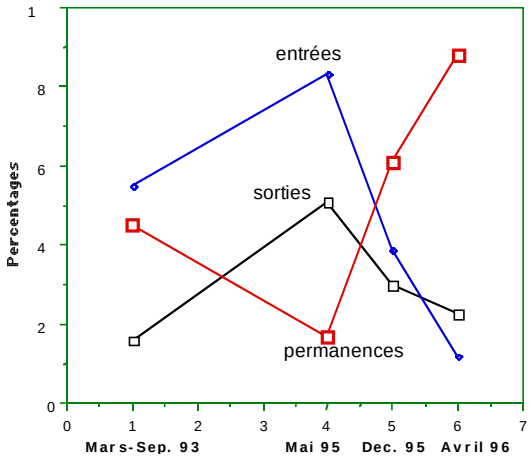


Figure 2. Transformations dans la composition de la liste

En tout cas, la population de la liste électronique n'apparaît pas comme une population « volatile ». La liste est effectivement un lieu de passage, où l'on ne reste pas forcément éternellement mais où l'on s'attarde un moment et même de plus en plus. Il y a une certaine fidélité à la liste. Ce caractère stable, continu, progressif de la composition signifie que la liste constitue un espace communautaire, non pas d'une communauté immobile certes mais avec une tradition, des orientations et normes de communication transmises et entérinées, par la pratique collective.

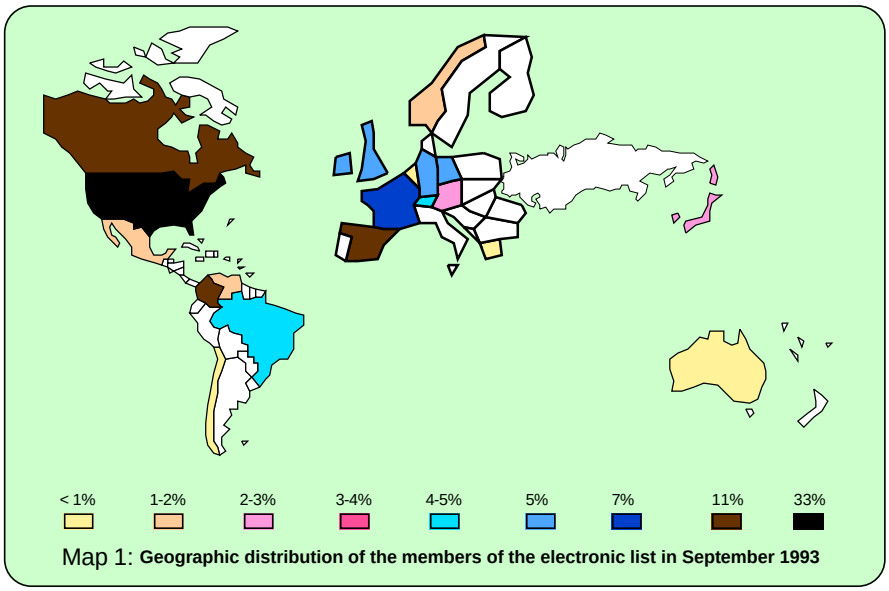
Une participation croissante de la communauté scientifique en Colombie

On constate une évolution géographique dans la composition des participants à la liste. Initialement très fortement centrée sur l'Amérique du Nord (USA et Canada) et l'Europe (France, Espagne), la participation se diversifie (elle passe de 13 pays en Mars 93 à 26 trois ans plus tard) et l'Amérique Latine prend une part beaucoup plus importante (Colombie et Brésil principalement) devenant la région au plus grand nombre de participants (cf. cartes 1 et 2).

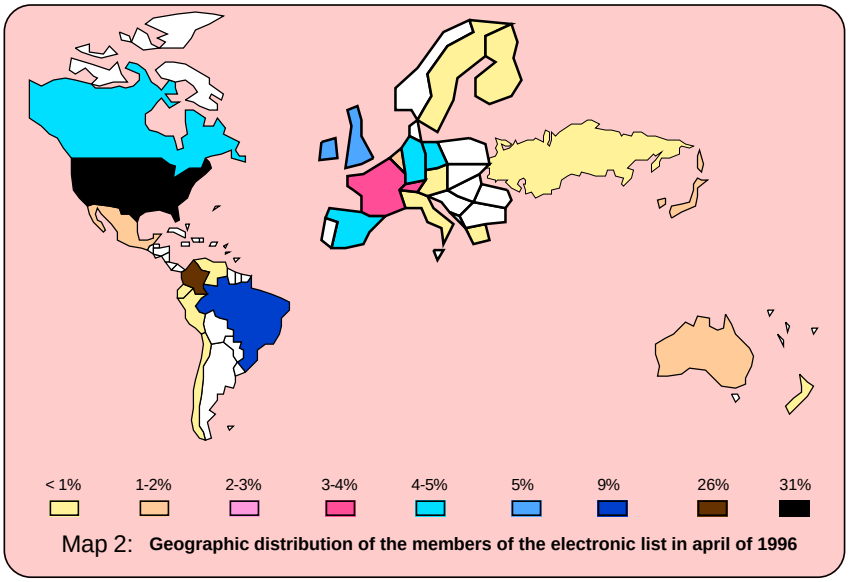
Il y a là deux phénomènes :

- le développement des réseaux électroniques dans les pays en développement où se trouvent de forts effectifs colombiens (pays latino-américains en majorité) ;
- l'internalisation (endogénéisation) en Colombie du réseau Caldas ; Internet a indiscutablement ouvert la possibilité aux résidents de communiquer avec leurs pairs expatrés et ils en ont profité. La Colombie est maintenant le deuxième pays en nombre d'inscrits (plus d'un quart du total), très près des USA et loin devant les autres pays. C'est aussi le pays qui a enregistré en pourcentage et en chiffre absolu le plus fort accroissement de ses connexions au réseau, ce qui prouve une diffusion interne du réseau et peut-être la fin d'un réseau diasporéique excentré.

Ce que l'on remarque également c'est une certaine stagnation et même parfois une légère diminution de la participation en valeur absolue dans certains pays : Espagne, France, Belgique, Canada, Autriche, et même USA dans une moindre mesure. Cela annonce-t'il une saturation du potentiel communicatif dans ces zones ou une lassitude des participants de ces pays ? Il apparaît significatif que ces pays soient souvent les premiers pays à s'être connectés et qu'ils renouvellent peu leurs participants aujourd'hui... Il faut également considérer que des listes dissidentes ou locales existent sur place...



Map 1: **Geographic distribution of the members of the electronic list in September 1993**



Map 2: **Geographic distribution of the members of the electronic list in april of 1996**

La dispersion géographique et institutionnelle des membres de la liste

Le réseau est géographiquement mais aussi institutionnellement dispersé. Très peu d'inscrits à la liste ont une adresse électronique voisine. La majorité des membres sont « isolés », à quelque moment de la période que ce soit. Pour eux, le réseau crée donc une proximité qui sans lui n'existerait pas. Les liens sociaux physiques ne semblent pas avoir de grand impact sur le réseau électronique. Les personnes qui s'y sont inscrites l'ont fait sans communauté locale, sauf peut être en Colombie même.

Cependant, on note une concentration croissante des effectifs : on passe de près des 3/4 isolés au début à presque la moitié de non isolés à la fin. Le nombre d'institutions décroît entre mai 95 et avril 96 alors qu'augmente le nombre de participants... Le phénomène est lié à la « colombianisation » de la liste : les grandes institutions colombiennes sont celles qui concentrent un nombre important de membres (Univalle, Colciencias, Uniandes, UNC, Javeriana). Elles sont massivement localisées à Bogota... Si l'on retire ces institutions colombiennes, la liste reste extrêmement dispersée, avec quelques petites concentrations locales, comme au Brésil, par exemple, ne dépassant jamais 5 personnes inscrites de la même institution. La diaspora est donc dispersée tandisque la communauté électronique colombienne est agglutinée dans quelques institutions. De nébuleuse originelle, le réseau passe progressivement à la forme d'un système centré, sur la Colombie.

Activité et intensité émettrices

Un accroissement massif du nombre d'émissions

Le nombre d'émissions de messages double chaque année (fig. 3).

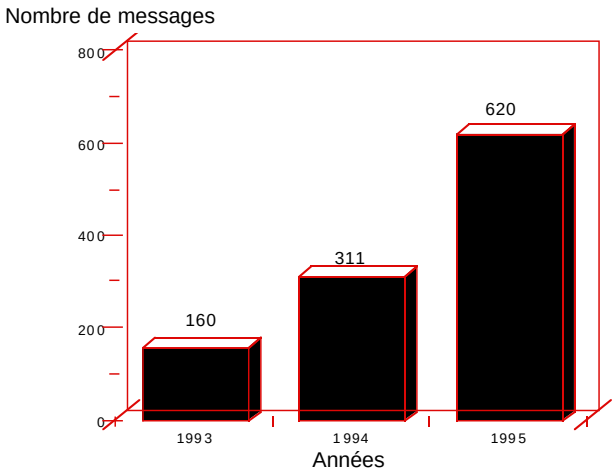


Figure 3. Nombre de messages par an

Cela se traduit par une densification progressive de la communication. En 1994 les jours d'émission représentent 39 % des jours de l'année et il y a en moyenne 2,2 messages par jour d'émission. En 1995 ce sont 56 % des jours de l'année qui sont des jours d'émission avec 3 messages par jour en moyenne.

En 1994, la moitié des messages possède une fréquence d'émission de un par jour, l'autre moitié s'échelonnant entre deux et 10 par jours, avec une faible quantité de jours à forte émission (> 3 messages/jour). Cela signifie qu'il y a saupoudrage, la majorité des messages sont émis à raison de un, deux ou trois par jour. L'évolution est très sensible en 95 : il y a moins de jours où seulement un message est émis et les jours d'émission avec un minimum de deux messages (maximum douze) sont deux fois plus nombreux. La majorité des messages est émise à raison de 3, 4, 5 et 6 par jour. Cela signifie une densification forte de l'émission et une intensification notable de la communication. Cela modifie la réception : on reçoit plus, plus souvent et chaque message vient généralement accompagné d'autres...

Cependant, si l'on compare cette activité émettrice à celle d'autres listes électroniques pourtant parfois moins nombreuses en inscrits, on constate qu'elle est quantitativement faible, d'une intensité relativement modeste. Cela tient au caractère de communication de la liste ainsi que nous le montrerons par après.

Une activité émetrice polarisée

L'activité émettrice est à la fois concentrée et dispersée. Un nombre important d'institutions et d'individus différents émettent à un moment ou à un autre mais la majorité des émissions se concentre autour de quelques-uns ou quelques-unes.

Les personnes émettrices

Il apparaît que la population de la liste est constitué en majorité de *lurkers* -inscrits « furtifs » (ainsi nommés par les reponsables d'une autre liste électronique, de sociologie des sciences)- qui n'émettent jamais. Près de deux inscrits sur trois sont dans ce cas (fig. 4).

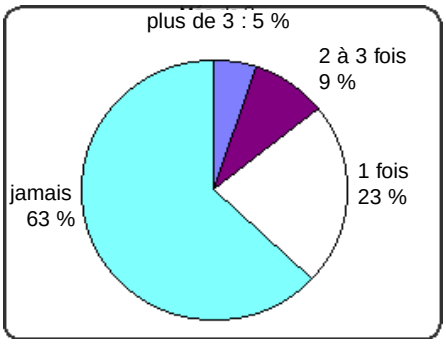


Figure 4. Proportion d'émetteurs par fréquence d'émissions

De plus, parmi ceux qui émettent, la part des émetteurs exceptionels représente également près des 2/3. Ceux qui émettent très ocasionellement représentent un peu moins de 10 % et les émetteurs significatifs à peine 5 %. L'intensité de l'activité communicative ou pour le moins émmetrice est inversement proportionnelle au nombre d'émetteurs. Ce phénomène de polarisation n'est pas surprenant et semble correspondre à une pratique électronique courante.

Si l'on considère la part de la communication électronique dévolue aux différentes catégories d'émetteurs, on constate que plus des deux tiers des messages émis (68 %) le sont par les émetteurs occasionnels (de 3 à 9 messages durant la période), les émetteurs fréquents (de 13 à 41 messages durant la période) et par la coordination de Colciencias (232 messages durant la période) (fig. 5). En revanche, les catégories émetteurs exceptionnels (1 message durant la période) et occasionnels (2 messages durant la période) ne représentent que moins d'un tiers du total de la communication électronique.

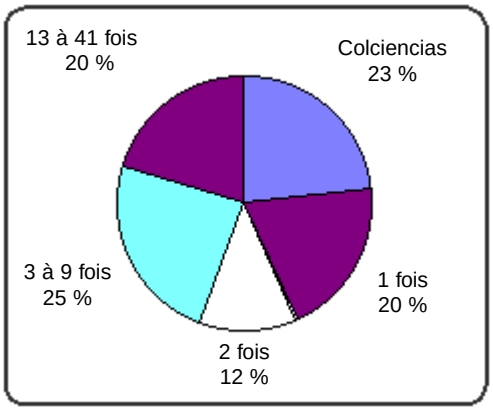


Figure 5. Proportion de messages par catégorie d'émetteurs

Que signifient ces chiffres ? Que l'espace communicationnel est connu et balisé. Il est marqué par des personnes, identifiées. Lorsqu'une personne émet plus de trois fois, elle est identifiée par les autres et a toute chance d'être reconnue, les fois suivantes... La communication électronique n'est pas anonyme et le sens n'est pas hasardeux, le contenu est construit bien souvent avec un pressentiment de ce que peuvent être les réactions. L'interprétation du sens se fait en fonction de ces points de repère. Le paradoxe c'est que le reste est un trou noir et c'est pourtant la majorité de ceux qui reçoivent et donc aussi interprètent...

Les institutions émettrices

Il y a 165 institutions émettrices.

78 émettent 1 fois (47 %) ; 29 émettent 2 fois (18 %) ; 40 émettent entre 3 et 10 fois (24 %) ; 18 (11 %) émettent plus de 10 fois.

La dispersion institutionnelle apparaît moins forte que la dispersion individuelle mais reste tout de même très importante. Et la polarisation reste évidente : 11 % des institutions émettent les deux tiers de l'ensemble des messages.

Un phénomène intéressant : si aucun des grands émetteurs individuels n'était colombien (ormis les coordinatrices de Colciencia), en revanche 5 institutions colombiennes sont parmi les 17 grandes émettrices et elles pésent 35 % de la comunication émise par cette catégorie (en éliminant Colciencias). Cela signifie une personnalisation moindre de la communication en Colombie et une répartition sur un nombre plus ample de personnes. On retrouve les grandes institutions inscrites (Univalle, Uniandes en tête, les « actifs électroniques ») avec un effacement des deux autres grands de Bogotá, UNC et surtout Javeriana au profit d'émetteurs provinciaux (Eafit et Uni Antioquia), dynamiques même si peu nombreux.

La Colombie : centre émetteur

Il y a 28 pays émetteurs (fig. 6).

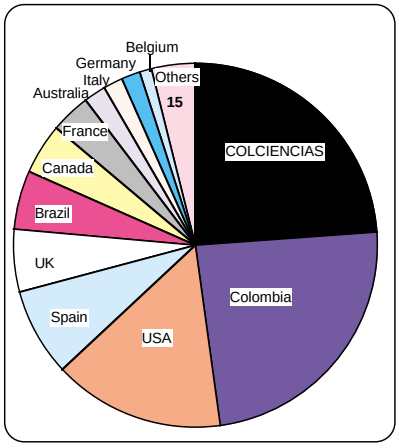


Figure 6. Emissions par pays

L'émission est plus ou moins dispersée ou concentrée selon les pays. Très concentrée en Suisse (20/inst. en moyenne), en Italie (8) et en Espagne (7,5), elle l'est moins en Colombie (un peu moins de 6 si l'on exclue la coordination de Colciencias) et au Canada, Brésil, Belgique et France (entre 4 et 6) ; les USA sont peu concentrés (3) et l'Allemagne très dispersée (1,2).

La Colombie a un taux d'émission plus élevé que sa moyenne d'inscrits, de même que l'Australie et à l'inverse des USA. Les autres pays sont plus ou moins équivalents : leur pourcentage d'émission correspond grosso modo à celui de leur nombre d'inscrits.

Ces chiffres donnent à penser que les participants « furtifs » sont moins nombreux en Colombie ; ceux de Suisse au contraire sont très nombreux ; il ya donc un contraste fort selon les pays. Il se pourrait que la connection à la liste procède de motifs différents selon les lieux où l'on se trouve. En Colombie, on se connecte pour passer des informations autant que pour en recevoir tandisque dans la diaspora on s'en sert comme d'un outil d'information constante sur les activités académiques du pays comme sur celles des compatriotes à l'extérieur. C'est une posture que nous dénommons : « veille stratégique individuelle »...

Le contenu de la communication

Une communication académique soutenue et de caractère national

Langues de communication

895 (87 %) messages sont en espagnol ; 39 (4 %) en espagnol et anglais; 91 (9 %) en anglais ; 1 en espagnol et portugais

La langue dominante est très largement l'espagnol. L'anglais n'est utilisé, conjointement ou seul, que dans 13 % des cas. La liste est donc éminemment latine et hispanophone ; même s'il s'agit d'une liste mondiale et scientifique, elle n'adopte pas la langue internationale ni celle de la science. Les messages en anglais sont souvent des importations : texte de l'extérieur, annonces d'événements, de postes, de bourses, etc. Cette langue est implicitement connue puisqu'il y a plus d'anglais que d'espagnol-anglais mais ce n'est pas celle de communication, ni le français, ni le portugais malgré le fait que des membres de la liste ne sont pas colombiens.

Longueur des messages

Repartissons l'ensemble des messages selon des catégories définies par leur longueur :

- moins d'une demi-page ; ce sont les messages courts, fournissant une information brève, une réaction spontanée, un échange au contenu peu développé ;
- entre une demi-page et une page ; ce sont des messages plus élaborés, l'équivalent d'une lettre, requérant quelques minutes de rédaction ;
- de une à deux pages ; l'équivalent d'une longue lettre, d'un échange préparé ou pour le moins auquel on dédie un certain temps d'expression ;
- de deux à 5 pages ; il s'agit là d'une communication très développée, avec un contenu substantiel, requérant une élaboration consistante de la part du rédacteur et un temps de lecture non négligeable ;
- de 5 à 10 pages ; c'est une information très élaborée, généralement préparée à l'avance et diffusée dans un deuxième temps ; le contenu est évidemment très substantiel ;
- plus de 10 pages : cas exceptionnels, retranscriptions d'articles longs.

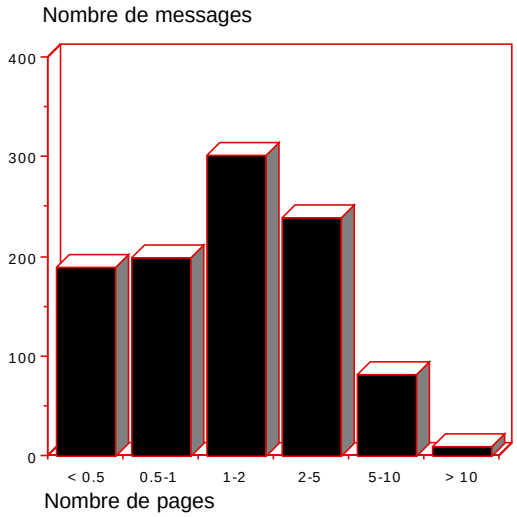


Figure 7. Taille des messages

La figure 7 indique qu'une majorité absolue de messages a une longueur comprise entre 1 et 5 pages. Cela révèle une communication indéniablement élaborée. Les messages sont pour la plupart travaillés et souvent préparés à l'avance. C'est assurément le cas pour tous ceux dépas-

sant deux pages et qui sont des envois de textes « importés ». Ils proviennent, en effet, soit d'autres listes électroniques, soit de l'extérieur de « l'électronique » et sont passés sur le réseau qui agit ainsi comme une plaque tournante d'information pré-élaborée. Dans le cas des messages entre une deux pages, il peut s'agir de textes pré-élaborés mais aussi de textes écrits directement pour le réseau. Cependant, même dans ce dernier cas, il s'agit d'un texte construit, structuré qui renvoit à un travail communicationnel élaboré. En moyenne, le réseau contient donc une information substantielle en terme de contenus et forgée par un travail préalable, effectué dans le courant de la connexion ou antérieur à elle. Mais le réseau est aussi un lieu de vie communicationnelle spontanée ou immédiat. La part des messages courts n'est pas négligeable même si elle est minoritaire.

La liste comporte donc les deux aspects : elle est en premier lieu un espace d'échange d'information élaborée, investie d'un travail d'acteurs, rendu récupérable par la circulation électronique ; mais elle est aussi un lieu d'expression immédiate, de partage instantané avec des échanges courts. D'autres listes Internet sont beaucoup plus centrées sur les messages courts, en forum d'échanges multipartites, comme une discussion autour d'une table ronde. Ceci n'est qu'un aspect de la liste R-Caldas qui ressemble plus, dans l'ensemble à un bulletin d'informations académiques, une *newsletter* dans lequel les contenus sont rarement développés comme dans un colloque ou une revue scientifique mais suffisamment pour alimenter le travail personnel des récepteurs.

Un usage instrumental beaucoup plus que social

Les grandes catégories de message

181 (18 %) messages ont un double contenu. Il existe 13 grandes catégories et 35 types de message différents (cf annexe 2, types détaillés et exemples de messages). (fig. 8).

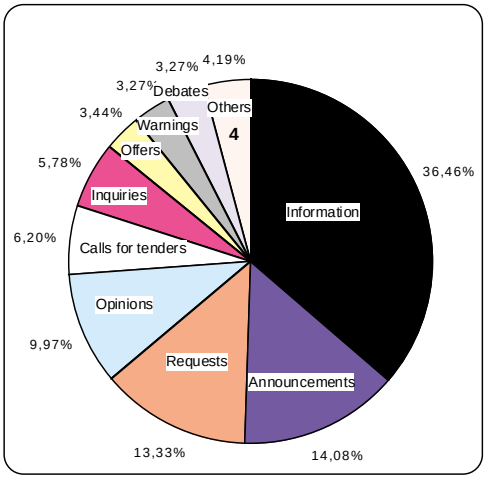


Figure 8. Types de messages

Si l'on considère la liste comme un lieu où s'opèrent des transactions, où s'échangent des communications et si l'on répartie par conséquent entre catégories « offreuses » et « demandeuses », les premières (information, annonces, opinion, convocations, avertissements, offres, suggestions, félicitations) sont largement supérieures aux secondes (demandes, recherches) : elles représentent 76 % contre 19 %, les autres catégories étant neutres ou réciproques (débats, remerciements, erreurs techniques). Cela donne à penser que la liste est avant tout un moyen de diffusion, pour les émetteurs, qui ne viennent pas tant y puiser qu'y offrir quelque chose. La liste agit plus comme un media que comme un forum ; un peu comme un journal qui délivre des informations, des annonces, des opinions... Cela doit être ce que les participants « furtifs »

viennent y chercher, eux qui ne s'expriment guère mais acceptent de recevoir et se satisfont de cet état de la communication. Ainsi, les émetteurs le sont au plein sens du terme (des offreurs) et les récepteurs égalements (receveurs). Répartition des rôles qui va à l'encontre de l'interactivité maximale du mythe Internet et s'apparente plus aux médias classiques. Les inscrits sont des abonnés qui s'aprovisionnent d'informations ou de valeurs virtuelles, c'est-à-dire potentiellement utiles.

Catégories d'usage des messages

Si l'on veut percevoir la totalité des messages et leur vocation de façon exhaustive, il faut regrouper par catégories non plus de types (cf. ci-dessus) mais plutôt d'usage apparent, ce à quoi ils servent. Nous avons ainsi défini 6 grandes catégories (fig.9) :

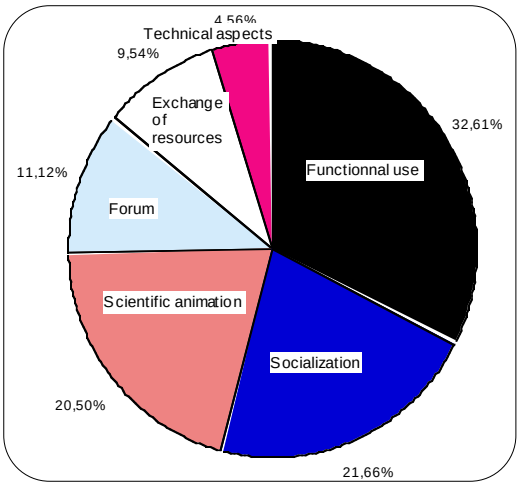


Figure 9. Finalité des messages

1/3 des usages sont fonctionnels, c'est-à-dire qu'ils remplissent une fonction pour l'usager qui les utilise ou peut les utiliser pour développer ses actions. Le réseau a donc un caractère instrumental : il sert à des fins pratiques, utilitaires, dans la majorité (relative) des cas. La liste électronique colombienne rend disponible un fonds de ressources communes qu'il fait circuler. Elle devient un vecteur de développement personnel potentiel... «Si je veux une ressource bibliographique, plutôt que de m'adresser à mon laboratoire local ou au Cyberespace impersonnel et universel, je vais questionner mes compatriotes...» C'est sûrement là, dans cette concrétude immédiate, dans ces intérêts directs auxquels pourvoit la connexion électronique que le réseau prend sa raison d'être et permet une identitification individuelle à un collectif de caractère national.

Mais la liste électronique est plus qu'un simple medium impersonnel, elle est aussi un lieu d'échange et de partage d'information. C'est un espace de communication au plein sens du terme : les individus y transmettent publiquement les informations qu'ils supposent d'intérêt général. C'est une source commune à tous, de référents partagés, probablement la seule dans le domaine intellectuel pour la diaspora colombienne et pour la communauté scientifique locale. C'est donc bien un creuset d'une pensée commune pour une population par nature dispersée. Les informations partagées (générale, formelle ou institutionnelle) sont un moyen de positionnement stratégique pour les acteurs : ils disposent d'un outil de veille sur les activités en Colombie et dans le réseau.

La liste électronique est un espace scientifique, indiscutablement. Une bonne part des informations qui y circulent revêtent un caractère académique direct. La liste est notamment une plate-forme d'annonce multidirectionnelle d'évènements. Elle est donc bien utilisée pour ce qu'elle a été créée et par ceux qui l'ont choisie et la maintiennent comme telle : l'académie. C'est un lieu d'échange de matériel communicationnel sérieux.

L'aspect forum renforce cette image : la liste est bien le siège de discussions et polémiques. Pourtant, celles-ci ne dérivent jamais en invectives et conflits violents ou dénonciatoires, comme fréquemment dans d'autres listes électroniques. Au contraire, les discussions qui démarrent parfois sur des évènements sensibles (essais nucléaires français, image de la Colombie à l'extérieur, prison de la Gorgone) est toujours invariablement ramenée à ses aspects techniques et scientifiques. Comme si, en dépit d'un tiraillement vers le socio-politique, l'académie reprenait toujours le dessus et traitait les problèmes à des niveaux différents. Rarement mais aussi périodiquement est-il besoin de faire appel à la vocation originale exclusive du réseau, pour le protéger de contamination.

Enfin, dernière dimension significative, la liste est un mécanisme de marché. Elle sert à diffuser l'information sur l'offre de postes académiques de façon extensive, neutre, homogène et anonyme (à tous de façon indifférenciée). Elle sort donc des « cliques » locales et s'universalise. D'une certaine façon, c'est même le marché parfait reconstitué, tel que l'imaginent les néo-classiques. Accès de tous à la même information au même moment, où qu'ils soient. Cela sort des réseaux socio-professionnels où la connaissance est restreinte, peu formalisée, lente et localisée.

Les aspects techniques représentent une minorité de cas, où le fonctionnement automatique de la liste ne va pas de soi. D'une façon générale, ce fonctionnement est quasi-naturalisé : les inscrits ne voient pas apparaître l'administrateur technique ; seulement de temps en temps vient-il, ou un débutant, rappeler que le fonctionnement dépend de conditions ou normes socio-techniques précises.

Dispersion sémantique des messages

900 messages ont été caractérisés par des mots clés, certains recevant jusquà 10 descripteurs. L'exercice consistait à tenter une qualification très fine de l'ensemble des contenus traités dans cette communication électronique hétérogène. Le résultat est éloquent mais intraitable quantitativement. Il y a plus de 1600 mots clés distincts et moins de 400 se répétant au minimum une fois. Cela révèle une dispersion sémantique énorme... Il n'y a pas un treillis de messages reliés entre eux mais bien une prolifération multidirectionnelle. Seul quelques descripteurs se détachent individuellement (plus de 20 occurrences) : Colciencias, Colombie, Université Nationale, Réseau Caldas, Universités del Valle, de los Andes, d'Antioquia... Les grandes institutions colombiennes apparaissent donc en premier lieu et tout d'abord Colciencias à qui le réseau sert donc de plate-forme évidente. La Colombie est fréquemment l'objet de discussions ou d'informations. L'Université Nationale, bien que peu présente dans le réseau électronique par ses membres inscrits et émetteurs, l'est beaucoup plus dans les contenus. Cela signifie que son poids dans les récits communicationnels est supérieur à sa présence physique, comme si, acteur incontournable sur la scène académique colombienne, on y référait à distance sans qu'elle même n'ait à intervenir directement. La présence des autres grandes institutions est plus conforme à leur importance comme émetteurs et récepteurs dans le réseau. Le réseau Caldas lui même est fréquemment l'objet de discussions dans la liste. C'est là une « réflexion » à l'intérieur de l'enceinte électronique, de la construction des associations constitutives de celui-ci ; les échanges électroniques à son propos reflètent les liens tissés sur le terrain ou parfois en constituent eux-mêmes la trame.

Le logiciel de cartographie des contenus « Leximappe » a été appliqué pour tenter de discerner les points forts, d'aggrégation sémantique, au travers de l'analyse des coocurences de mots clés. Celles-ci ne pouvaient porter que sur 1/4 de l'ensemble des descripteurs (400 se répétant au moins une fois, sur un total de 1 600). Elle permet effectivement de faire apparaître des *clusters* ce qui signifie que la dispersion n'est pas absolue. Mais les aggrégations s'effectuent sans pour autant représenter des points statistiquement très significatifs de l'ensemble de la communication puisque elles se réalisent parmi une multitude de descripteurs particuliers. Ce sont quelques archipels (un débat, la répétition d'annonces d'un évènement, une convocation à un concours) dans un océan de mots clés...

Le travail scientifique à travers le réseau électronique

Sélectivité implicite de la communication

Les messages destinés à l'ensemble des membres sont une minorité (36 %). La majorité concerne des groupes spécifiques, thématiques, géographiques, des institutions ou des individus. La liste n'est donc pas un lieu où tout se donne à tous sinon plutôt un espace de transactions rarement particulières mais souvent spécifiques. La liste n'est pas une tribune d'où l'on s'adresse à la collectivité mais un treillis de relations de communications collectives sélectives. Une majorité relative (46 % des messages) est destinée à des récepteurs thématiques (fig. 10).

La dispersion thématique est importante : il n'y a pas moins de 71 thèmes recensés (cela représente une moyenne d'un peu moins de 8 messages/thème), certains très généraux (disciplines) comme la physique, d'autres très spécialisés comme la violence, par exemple. Cela rejoint les résultats de notre enquête postale : la diaspora est un monde socio-cognitif disparate, thématiquement guère moins dispersé que géographiquement.

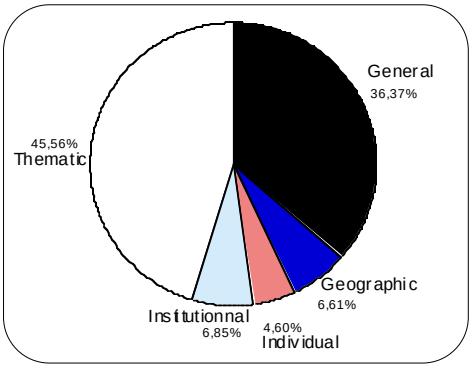


Figure 10. Groupes de récepteurs implicites

Comparaison thématique entre l'activité du réseau électronique et celle de la communauté scientifique colombienne locale

Les groupes thématiques se répartissent par grands champs disciplinaires selon la figure 11. Deux (nouvelles technologies et sciences exactes) d'entre les neuf identifiés représentent plus d'un tiers de l'ensemble. Ils sont suivis par les sciences naturelles, la politique scientifique et les sciences de la terre et de l'environnement qui regroupent à eux trois un tiers des messages. Enfin les 4 dernières catégories représentent moins de 10 % chacune (sciences sociales, santé, ingéniéries et technologies traditionnelles et économie-droit et administration). Cette dernière catégorie est de très loin la plus faible.

Les orientations thématiques et disciplinaires visibles dans le réseau électronique sont elles différentes ou similaires à celles identifiées dans la communauté scientifique colombienne ? Si l'on compare champ par champ, le nombre de messages thématiques avec le nombre de publications produites en Colombie, on obtient une image diamétralement opposée (fig. 12). Les thématiques fortes dans la communauté scientifique colombienne sont faibles dans le réseau électronique et inversement. Cela tendrait à dire qu'il y a une certaine complémentarité entre les deux entités.

Nous avions montré dans un article antérieur (Meyer, Charum, Granés, Chatelin 95) que les composantes disciplinaires de la science pratiquée en Colombie reflétaient une certaine orientation positive vers des problèmes locaux que la recherche s'attachait à résoudre. Mais nous

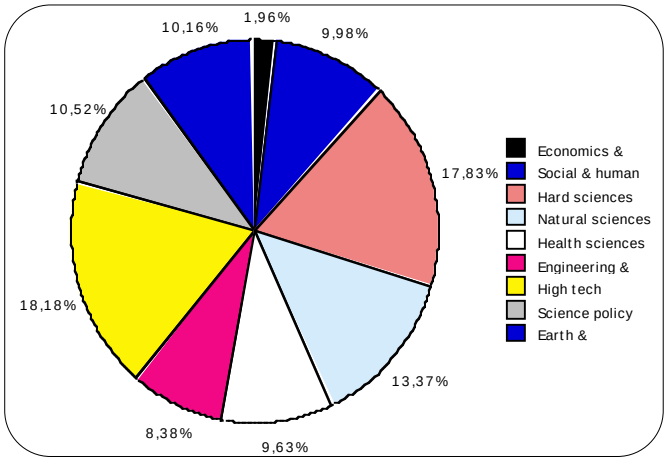


Figure 11. Distribution thématique des messages

avions aussi souligné la faiblesse du secteur « technologies nouvelles » qui traduisait un handicap structurel du pays en innovation technologique et limitait sa capacité de développement socio-économique dans un contexte ouvert. L'activité prononcée du réseau électronique dans ce secteur tendrait à révéler un potentiel susceptible de corriger cette faiblesse, une capacité de générer l'innovation à partir de la diaspora, rendue ainsi complémentaire de la communauté locale dans un secteur stratégique. Pour vérifier cette hypothèse, il faut examiner si la concentration thématique « technologies nouvelles » relève plus des membres de la diaspora que de ceux de la Colombie. Or il apparaît que la majorité des messages thématiques dans ce secteur émis par le réseau, le sont par des chercheurs installés en Colombie même. Cela vient-il infirmer l'hypothèse précédente ? NON, car l'étude détaillée de ces messages révèle plusieurs choses :

— Bon nombre d'entre eux sont des « demandes » et non des offres, c'est-à-dire que les institutions colombiennes cherchent par le réseau à obtenir des informations, des compétences ou des ressources, qu'elles ne peuvent trouver dans leur milieu local et pensent pouvoir acquérir en mobilisant la diaspora (types de messages : appels d'offre, recherche de contacts, offres de postes, etc.). Cela confirme une orientation externe du secteur.
— Plusieurs messages sont émis depuis la Colombie mais renvoient à des actes remplis dans d'autres pays (Chili, Espagne, Mexique, etc.). Les membres colombiens du réseau, interréssés aux technologies nouvelles, puisent donc largement à l'extérieur du pays.
— Les annonces faites sur le thème, à réaliser en Colombie :
- émanent d'institutions non centrales ou non dominantes dans la communauté scientifique colombienne (provinciales bien souvent : Univalle, Eafit, UNC-Medellin, Uni-Antioquia, UNC-

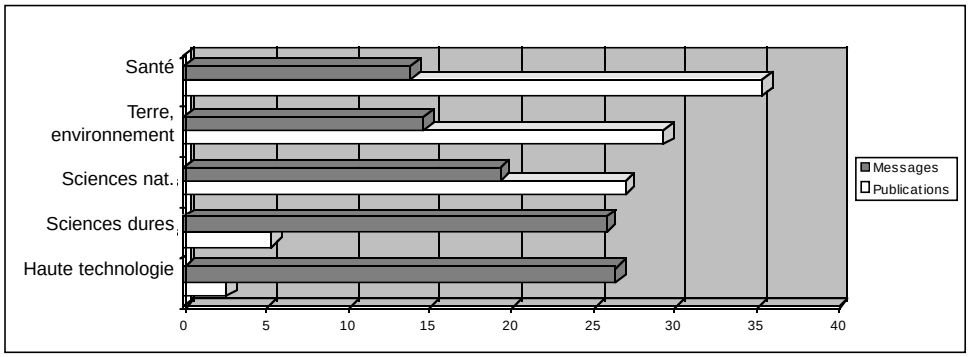


Figure 12. Comparaison par grandes disciplines du nombre (%) de publications scientifiques de la Colombie et de messages dans la liste du réseau électronique
Sources : Pascal, enquête électronique

Manizales ou Uni-Andes à Bogotá). Notre étude antérieure montrait que la production scientifique colombienne était massivement centrée sur Bogotá aux dépens de la province et fortement concentrée sur l'université nationale dans cette ville. Or cette dernière est absente dans ces thématiques dominantes exprimées par le réseau électronique. En revanche, les autres institutions, peu visibles dans la production colombienne, le sont ici beaucoup plus que la précédente.
- réfèrent souvent au montage de nouveaux programmes de recherche (à leur début) ou de formation ainsi qu'à des premières rencontres nationales ou le montage d'un réseau ou le premier bulletin, etc. soulignant ainsi le caractère nouveau de ces activités en Colombie.

En définitive, ce que tend à démontrer cette comparaison entre thématiques locales et thématiques du réseau c'est un rééquilibrage en cours. Le réseau comble les lacunes thématiques, géographiques et institutionnelles en renforçant les secteurs disciplinaires mineurs à l'échelle nationale et en les concentrant dans les lieux où l'activité était précédemment limitée. Il pallie ainsi les discontinuités du tissu scientifique local. Tout se passe comme si des acteurs en Colombie investissaient ou se créaient un nouvel espace, celui des technologies nouvelles, pour développer des capacités de recherche, en s'appuyant sur la diaspora. Les grands acteurs traditionnels locaux, installés dans d'autres problématiques scientifiques, sont absents et laissent vacants ces espaces que les nouveaux s'efforcent d'occuper. L'orientation vers l'extérieur du pays de ces nouveaux acteurs s'aligne également sur des dominantes plus « mainstream » que locales mais elles sont aussi susceptibles de donner au pays la capacité d'innovation technologique qu'il requiert dans le contexte d'économie ouverte qu'il s'est choisi au début de la décennie.

La synergie possible entre diaspora et communauté locale apparaît ainsi des plus prometteuses. Elle ne naît cependant pas de la nature des choses mais du travail des acteurs. Pour réaliser effectivement ce potentiel disponible, il faut créer ou développer les associations stratégiques au cas par cas. Nous avons ici démontré qu'Internet ouvrait en ce domaine une perspective extrêmement féconde.

Perspectives of Statistical Analysis in the Study of Scientific and Professional Migrations

Alvaro Montenegro

Introduction

This paper presents the methodological study to carry out the survey “Colombia Network”, within the framework of the research project “Brain gain revisited through the Colombian case. Study of the Caldas Network” [1]. The objective of the project is to make a detailed analysis of the population of expatriate Colombian researchers, organized mainly around the Caldas Network [2]. The survey was sent to expatriate Colombian researchers that this group of researchers located in 24 countries. Different means were used for sending the survey, among them mainly the air mail and the electronic mail.

The tools

The statistical analysis of the information collected, requires at least the use of the following tools

Data base system

The costs for launching and gathering the information in an international survey is very high, and thus the information collected must be sufficiently wide, in such a way that the most advantage is taken of the effort made. This implies that the survey will have information of very varied types and for the analyses complex reports will be required. Thus, it is indispensable to build in a technical manner a standardized data base to store the information. The information must be entered to the data base already coded, so it will be necessary to use standard classification tables. In the case of the survey “Colombia Networks”, UNESCO discipline tables and the Pascal base classification system were used for coding the schooling, research fields and labor activities data.

Programming language

Experience has shown us that notwithstanding counting with a sophisticated data basis and having experience in its use, the preparation of the data for statistical analysis, after they are out of the data basis is in many cases very complex. According to the kind of analysis required, the data must be reorganized and coded again, before entering to the statistical tools.

Electronic sheet

The modern electronic sheet is of invaluable help for the manipulation of information. The best statistical graphs may be obtained from this tool. In addition, a good part of the new coding and data reorganization work may be done with this tool.

Statistical tools

The election of statistical tools depends on the type of analysis required. In social studies, the most usual recommendation is to use tools based on data analysis techniques. As discussed in section 2, the purpose of the French approach of data analysis is to discover and describe the characteristics present in a population, as opposed to the parametric methods, the purpose of which is to model and then test.

Techniques

In addition to the descriptive analysis techniques, the data analysis techniques are the most indicated techniques for social studies. For the analysis of the survey “Colombia Networks” the following data analysis techniques have been used :

Simple Correspondence Analysis (SCA)

By means of this technique it is possible to compare two categorical variables. In the SCA answer profiles are built from the cross matrix of the two variables, and their purpose is to find an space in which the total inertia of the data may be broken down only along the new axes. The initial data matrix is of a size *n*m*, where n and m are respectively the number of categories of each variable, and the element *ij* of the matrix is the number of individuals who simultaneously present the categories *i* of the first variable and *j* of the second variable. In the calculation the distance chi-square is used, which has the characteristic of giving less weight to the more frequent categories, and more weight to the less frequent ones, which just because of their low frequency are the ones that determine the analysis. The final result is the obtaining of the charts (factorial charts) in which you can observe the relationships between some categories and others, taking into account the following interpretation principles :

- The two variables can be represented simultaneously in the same factorial chart.
- The most frequent modalities are represented close to the new coordinated origin. These are the common characteristics of the population. The less frequent modalities appear far from the origin. These are the characteristics that differentiate the population.
- The modalities that appear relatively close to each other are characteristics of a same group of individuals and therefore characterize same.
- The position of any modality *i* (respectively *j*) in a factorial chart is the baricenter of all modalities (respectively *i*) of the other variable which were selected simultaneously with the modality *i* (respectively *j*) in the answers to the survey.
- Additional modalities (which will be explanatory) may be plotted in the factorial chart in order to complete the characterization of the groups present in the population

Multiple Correspondence Analysis (MCA)

The MCA is the natural extension of SCA, to analyze simultaneously multiple variables. The initial matrix for the analysis is now an n*p matrix, where n is the size of the sample and p the total number of categories present, including all the variables for which the analysis will be made. The objective of MCA is the same as in SCA, that is, it seeks to find a space in which the inertia of the cloud of dots will be totally broken down along the new coordinated axes. The chi-square distance is also used and has the same effects as before. The principles of interpretation are similar to the SCA, taking into account that in this case the origin of the factorial charts is the baricenter of all categories.

Analysis of textual data

It is the most recent data analysis technique. It derives from SCA, with the characteristic that it adapts to the management of very disperse huge matrixes. This technique was developed for the analysis of literary texts and particularly for the analysis of open questions of surveys. The method base is in the creation of the lexical variable where its categories are each one of the different words present in the text. The matrix for the analyses is generally an *n*p* matrix where *n* is the number of texts and *p* the number of categories of the lexical variable, and the analysis is a SCA. In the study of the survey "Colombia Networks" it has been found that the tool may be successfully used in the analysis of biographical information and in obtaining scientific charts from key words.

Analysis of clusters

The three above mentioned techniques are sufficiently descriptive so that with some experience the researcher may have an idea of what happens in the population, form the direct observation of different factorial charts. However, in order to have an exact description of the population studied, it is necessary to make cluster analyses on the date from their locations on the factorial charts. This process will permit at the end to describe the population such as it is without losing the multi-variant reality present in the data.

The associate words analysis

This technique is used in scientometrics to analyze the contents of a documental data corpus data that is built by key words used to index the original documents.

The base of the method is to calculate the association coefficient between two words. Let´s be *i, j* two words of the corpus. The association coefficient between *i* and *j* is defined by

$$E_{ij} = \left(\frac{c_{ij}}{c_i}\right)\left(\frac{c_{ij}}{c_j}\right)$$

where c_i and c_j are the frequences of *i* and *j* words respectively in all corpus, and c_{ij} is the frecuency of coocurrence of the words *i* and *j* in a same text.

The association coefficient is calcutated for all couples of words that have a frecuency greater than a threshold. From the association coefficients a cluster analysis is made, and clusters of word are obtained. Each cluster determines a theme present in the corpus.

Two index are calculate now for each cluster. The centrality index and the density index. The cen-

trality index of a cluster of words is the mean of the association index betwen the words of the cluster and the words of the others clusters. In other words this is a relational index inter clusters. A theme is more central if it´s more connected with the others. The density index is the mean of the the association coefficients inside the cluster. A theme is more dense if it has more development. The two inedex allow to built a two dimensional strategic diagram, by cross of the centrality index (first axis) and density index (second axis) of each cluster. The diagram´s origin is the median of centrality index and the density index respectively. The diagram has four quadrants that can be interpreted.

- First quadrant (greater centrality, smaller density) presents the development themes, the reference themes.

- Second quadrant (smaller centrality, greater density) presents las temáticas desarrolladas con poca influencia global.

- Third quadrant (smaller centrality, smaller density) presents the new themes, the nascent themes.

- Fourth quadrant (greater centrality, smaller density) presents the developing themes, the link themes, the promising themes.

Data types

The data types of the survey must be carefully defined before designing the survey and must correspond to the purposes of the research. In the case of the survey Colombia Networks, the object in general is to describe the situation of the identified group of expatriate scientific Colombians in terms of :

Socio-demographic data

- Age, sex, nationality (ies) of the surveyed person and his close relatives, schooling, current activity.

Biographic data

- Residential history
- Academic history
- Labor history

Research Field data

- Fields and key words that describe the contents of the research.

Factual Data

- Type of active relationships maintained with Colombia.
- Type of entity in which he works.
- Communication media used.
- Belonging to Colombian association networks

Opinion data

- Level of satisfaction and expectations with respect to current work.
- Benefits and contributions expected with respect to the Caldas Network.
- Favorableness and difficulty conditions to establish active relations with Colombia.
- Successes and problems of the Caldas Network, evolution of science and technology in Colombia (open questions)

Publication data

- References data.

Methodology

Figure 1. shows the methodological process that has been followed in the survey "Colombia networks". The methodology is applicable to any study of this type. Each one of the steps is described below.

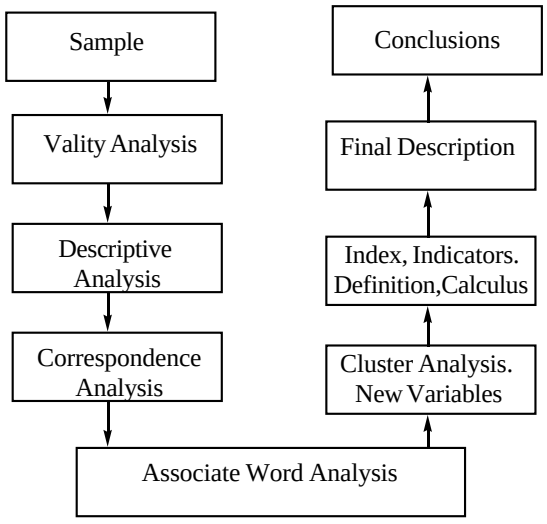


Figure 1. Scheme of methodology for the statistical analysis of scientific and proffesional migrations

The sample

In a type of survey such as the "Colombia Networks" survey, it is highly unlikely that a sampling can be made following some of the traditional sampling models because of the following reasons :

- There is not a complete sample framework.
- It is not possible to interview the surveyed people directly.
- There is no certainty of locating each individual, due to their mobility.
- The probability of an answer is not the same in each country.
- The object of the study is very dynamic.

The surveys for the study of scientific and proffesional migrations must be sent to different parts of the world. The primary source of information to locate the individuals to be studied is

found in the government files which generally are incomplete and are not always updated. Therefore new sources must be located, in such a way that it will be possible to find other individuals and thus increase the framework. For the "Colombia Networks" survey, the start was Colciencias data base, an entity that orients the policies of science and technology in Colombia, in which were recorded and totally identified 826 Colombian researchers and proffesionals abroad, in the year 1994. Our researchers were located thanks to the information received from some of the people surveyed, and others from lists of node coordinators of Network Caldas at several countries.

The methodology for obtaining the sample must take into account the difficulties mentioned above, in order to guarantee to the extent possible the reliability of the results obtained. The steps proposed are the following :

Decide the number of forms to be sent

With the information available on the locations of people, it is necessary to decide, in accordance with the available budget, what will be the number of forms sent, and which the method for sending them. All available information must be used, in order to obtain a sample that will be really significant of the population studied.

A prior estimate of some parameters results useful for decision making prior to sending and after receipt of the forms. The hypothesis that can be handled for example is that the government data base represents a good sample of the population studied. If this is assumed, then it is possible to make for the case of the scientific and proffesional migrations the following estimates :

- The population is considered geographically divided, and thus it is possible to assume a multinomial model, where each category is a receiving country. Then it is possible to estimate the proportion of individuals in each country. Note that it is not possible to establish confidence intervals, since the size of the population is unknown.
- If there is any additional information available, for example the work area, research, schooling, etc., it may be used additionally. For example, in the case of the study "Colombia Networks", the classification from the research programs of Colciencias was available. This additional information permits to estimate parameters of interest for the study. For the case of scientific migrations it is more important that the sample will be very representative of the scientific areas, even though it may get a little (although not too much) far from the geographic distribution.

Receive the surveys and store the data

All the information coming from the surveys must be stored in the data base built for that purpose. Figure 2 presents the main menu of the data base of the survey "Colombia Networks".

Analysis of the validity and representativeness of the survey

It is the first important step of statistical analysis and can not be omitted. From the result of this analysis will depend whether a subsample should be taken or give different weights to some individuals. In addition, it should be indicated whether the conclusions are really applicable to all the population under study. Within the study of the survey "Colombia Networks" the chi-square conformity tests described below were performed.

- A comparison was made of the distribution of sending by countries and receiving by countries. The distribution of receiving was perfectly in conformity. Figure 3 shows the comparison.

- A comparison was made of the distribution by countries of Colciencias data base and the subsample resulting from the surveys obtained from the Colciencias data base. The subsample was perfectly in conformity. Figure3 shows de comparision.

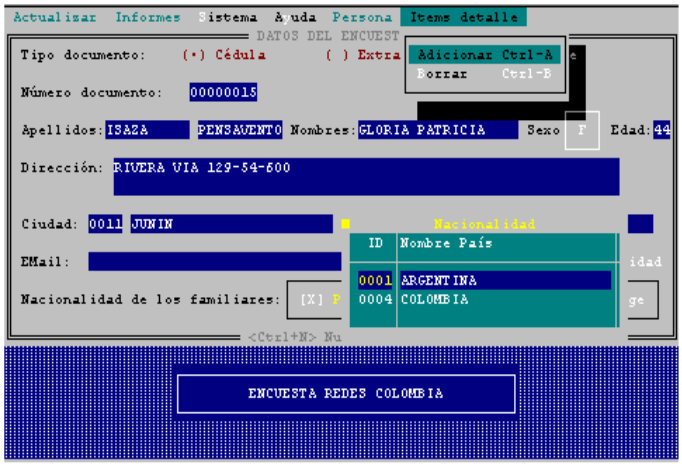


Figure 2. Main menu of “Colombia Networks” Survey

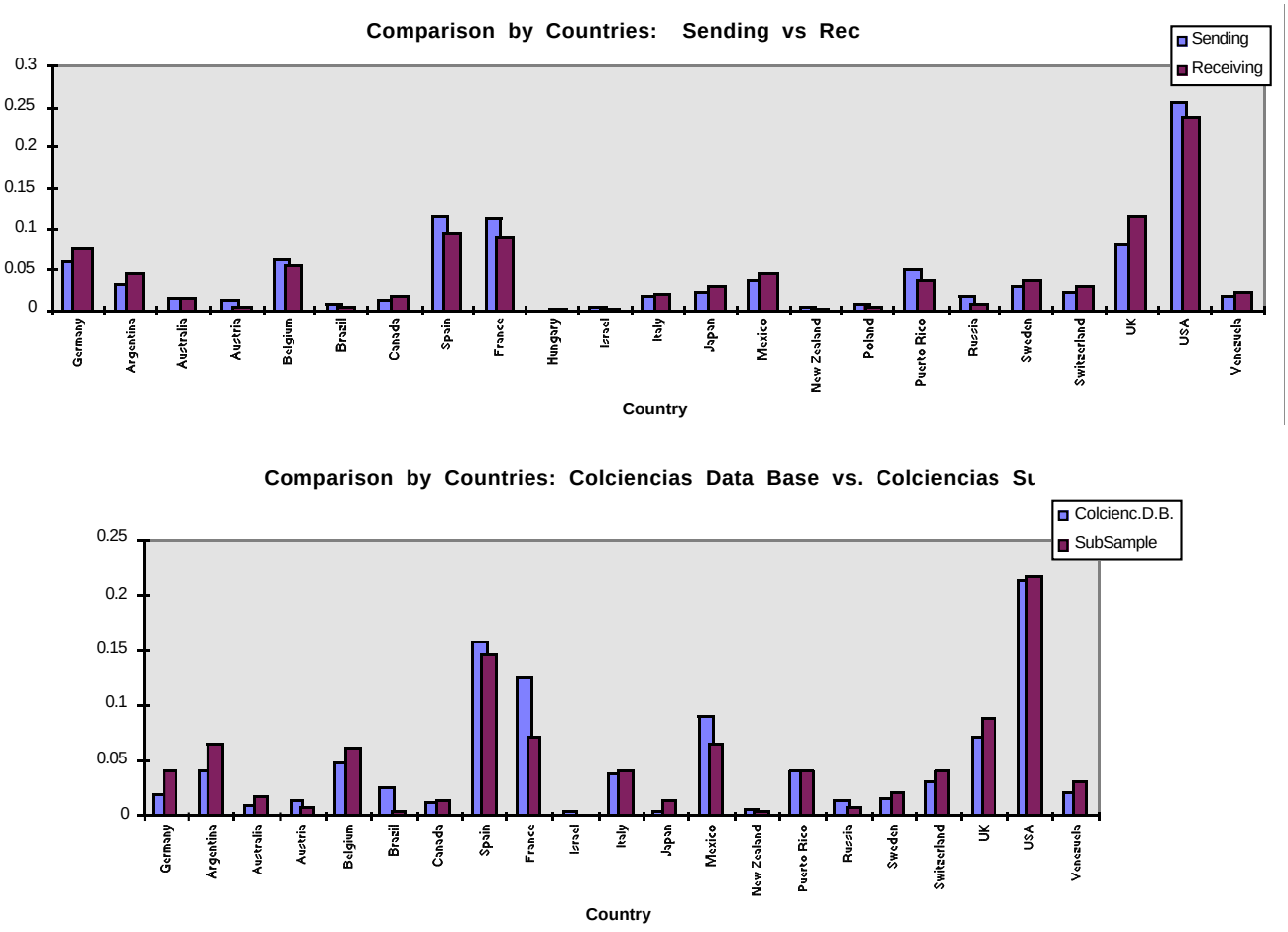


Figure 3.

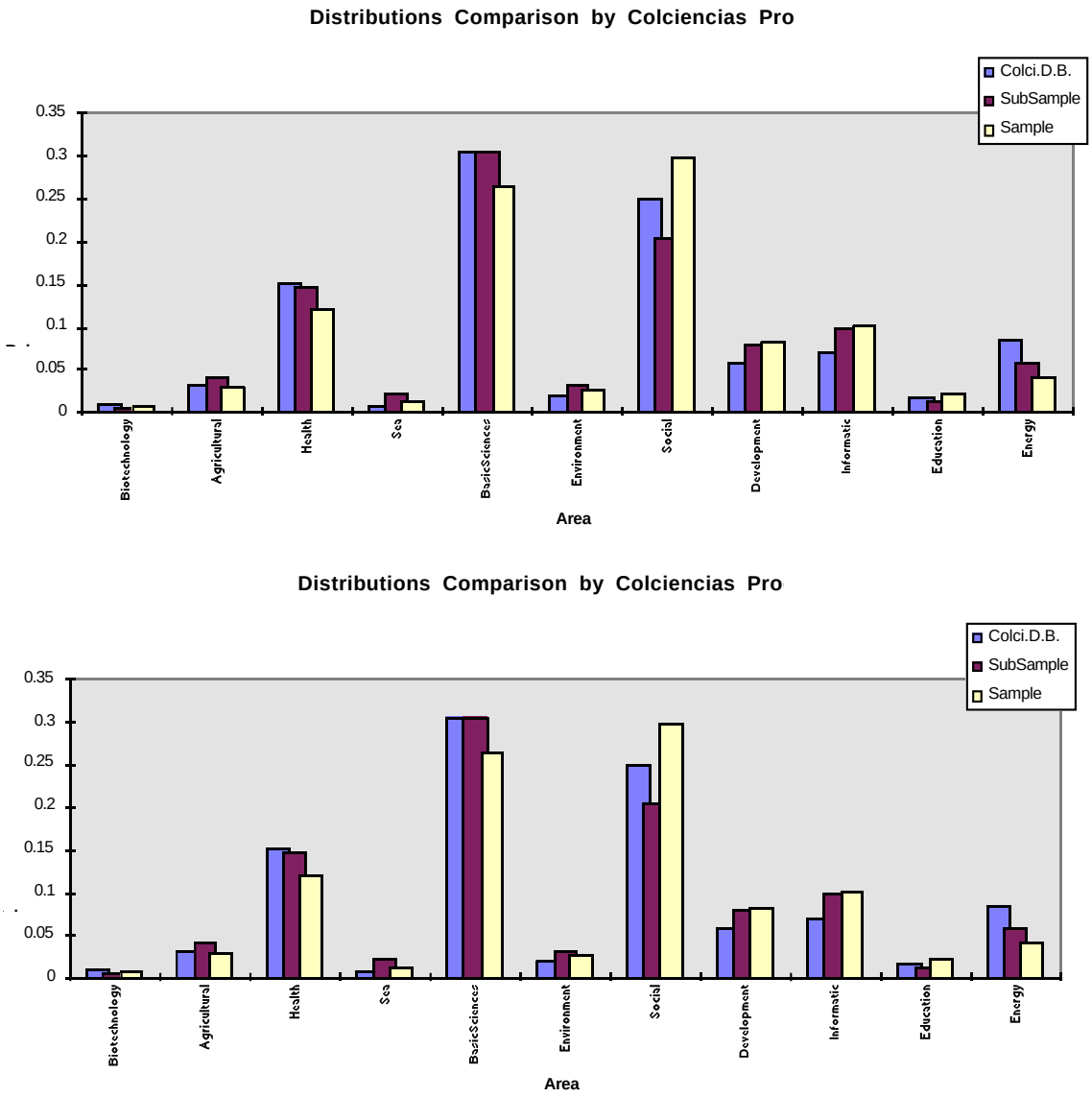


Figure 3. Sample Analysis of Survey “Colombia Networks”. Comparison of distributions

- A comparison was made of the distribution by research programs, of the subsample resulting from the surveys obtained from the Colciencias data base, with the parameters from Colciencias, with positive result.

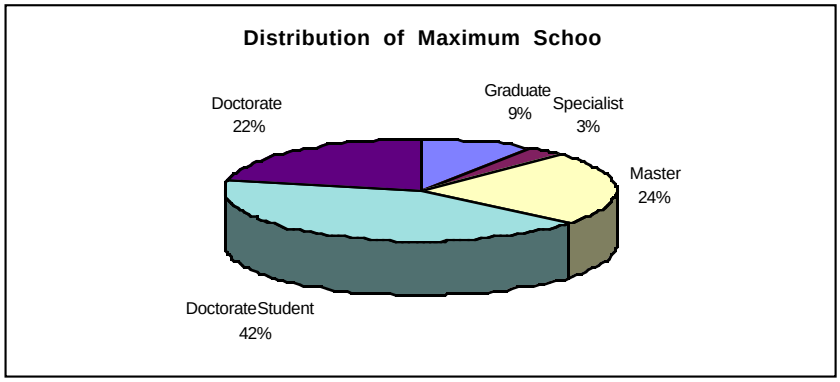
- The almost full independence of answer within each country was verified, comparing the distribution, by research programs for the sample and subsample respectively. In the case of the total sample only in two countries, the parameters did not conform well. He have in this cases more individuals located, coming from sources other than Colciencias.

The conclusion is that the sample is very representative of the population studied and therefore, how the study is principally descriptive (exploratory) it is possible to continue with the following step of the analysis without any modification. Figure 3 shows the comparison of the distributions by research programs of the total sample and of Colciencias data base of 1994, in the survey “Colombia Networks”, in general and the internal comparison within the United States.

Finally, it´s necessary to understand that the results obtained should be interpreted how trends that is presents in the populations, and they are not parameters.

First descriptive analysis

This first step is necessary in order to have a first impression of the global characteristics of the population even in an isolated manner. Some first conclusions may be obtained already. For example, it is possible to say that the population examined in the survey "Colombia Network" is made up by 69 % men, that most of the population distributes their time between work and research (35 %) and between study and research (25 %). That 87 % of the population surveyed has to do with research processes, either as students who pursue a Masters or Ph.D. degree or as professional researchers, that 83 % have a schooling level between a Masters and a Ph.D. degree, that the most frequent labor migrations occur between the countries of the United States, France, Spain, England, Mexico, Germany, Argentina, Brazil, Venezuela and obviously Colombia. That most people migrate for the first time for school reasons, etc. This information is in fact useful for some decision making. In effect, it may be strategic information for some entities. For us, it represents really the first contact with the data. Figure 4 shows two examples:



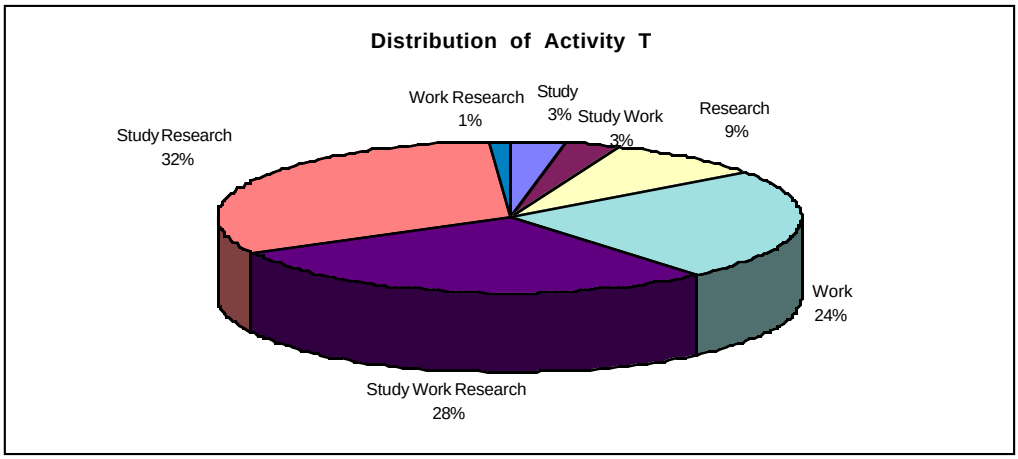


Figure 4. Examples of descriptive analysis

First data analyses by subject (First data classification). Some examples

This step is one of the most complex ones. It is the step when it will be necessary to make new codifications, reports in different ways, etc.

The purpose is to advance by subjects in the analysis. Every subject identified is treated separately. It is not a better analysis that which is made putting together all the variables, among other things, because each subject by itself requires attention and possibly differential treatment. In the case of the survey "Colombia Networks", some analysis were made, among others, which results and most relevant aspects are noted below. Only a few examples have been chosen.

- Socio-demographic analysis

The socio-demographic variables were chosen, with the idea of establishing a classification of the population from that point of view. The result obtained is that the entire population is very homogeneous and with the exception of the family ties that connect some of the people surveyed with the country of residence, the rest of the characteristics are common to most of the population.

- Active relations with Colombia

Fourteen variables were used, with a total of 10 categories. The variables were submitted to a MCA, the first factorial chart of which is shown in figure 5. The analysis seems to show the existence of four large groups. Some that maintain formal relations, others that maintain temporary relationships and others that do not have any relations with Colombia, and a cluster of no answer. The analysis of clusters confirms this suspicion and in addition, the projection of socio-demographic variables helps to find some additional distinctive characteristics of each group. In the next step, each one of the clusters must be analyzed in depth. As of now, it has been sufficient to identify the groups and have a first description of each. The final step in this part is to create a new variable, the Active Relations variable, with four categories, each one associated to one of the resulting clusters. Figure 6 presents the description of one of the clusters. Both results come from the statistical program, then from the SCA and from the classification, respectively.

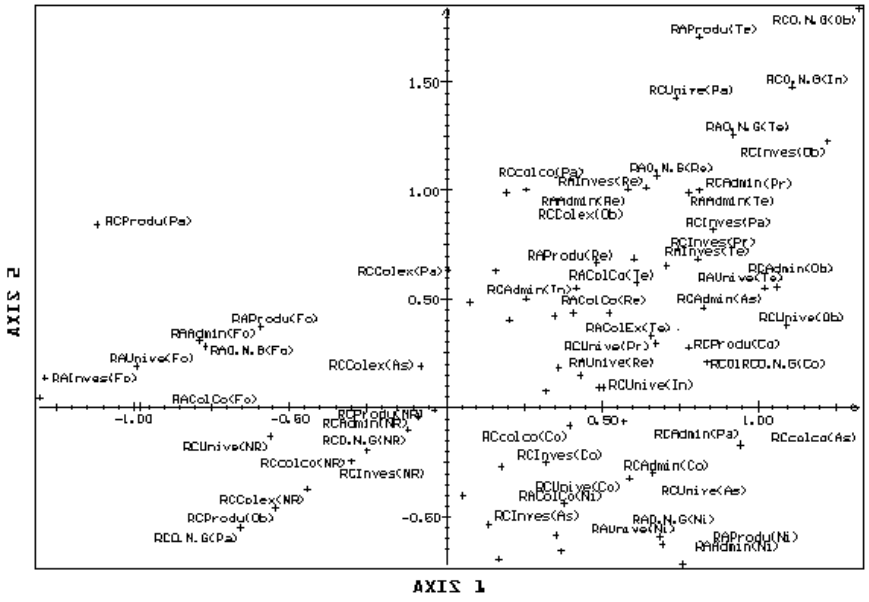


Figure 5. Factorial chart of the subject active relations with Colombia (14) Variables

GLOBAL CHARACTERISTIC					
V.TEST	PROB.	PERCENTS	CLAS/MOD	MOD/CLAS.	MODALITY
8.54	.000	66.67	46.67	9.27	RAColCo(Re)
8.23	.000	84.00	35.00	5.52	RAInves(Re)
7.86	.000	51.67	51.67	13.25	RCUnive(Pr)
7.45	.000	52.83	46.67	11.70	RAUnive(Re)
6.43	.000	68.00	28.33	5.52	RAAdmin(Re)
5.92	.000	36.71	48.33	17.44	RAColEx(Re)
5.10	.000	47.22	28.33	7.95	RCInves(Pr)
4.64	.000	41.46	28.33	9.05	Rccolco(Pr)
4.33	.000	72.73	13.33	2.43	RAO.N.G(Re)
3.86	.000	23.66	51.67	28.92	RCColex(Pr)
2.96	.002	35.71	16.67	6.18	fisica
2.39	.009	45.45	8.33	2.43	RCAdmin(In)
- 2.41	.008	8.96	31.67	46.80	RAAdmin(Fo)
- 2.43	.008	11.66	78.33	88.96	RCAdmin(NR)

Figure 6. Description of Cluster 2 of the subject active relationships with Colombia. The upper list are the dominant characteristics and the lower list are the farthest characteristics.

- Analysis of residential migration

Recent techniques such as the qualitative harmonic analysis have been developed although not fully implemented in a statistical program, for the analysis of migration routes. Within the analysis of the survey “Colombia Networks” a strategy based on the analysis of textual data has been successfully used, which we describe below because it represents a methodological contribution for this type of problems. For the study of longitudinal data, the “traditional” strategy which has been followed is as follows : first time is set at discretion, defining periods (which may be historic or the age of the population surveyed), and grouping the locations of destination in accordance to some criterion. Then the two variables are crossed, time set at discretion by groups of destination obtaining a variable of states where every modality is a time space by a geographic space. To every category is associated the percentage of stay in such states for every individual, thus obtaining a matrix of individuals by states, which is submitted to analysis of correspondence and then to the classification. The customary interpretation techniques are then used.

The technique of textual data analysis has been used in some studies although according to our criterion, in an erroneous manner. What we have done is code again the data as shown in figure 7. That is, we have assumed for every individual a textual answer of the form:

Country1 Area_Continental_1 country1_age1 country1_age2...

Country1 Area_Continental_1 country1_age1 country1_age2...

That is, we have described the entire residential history year by year in the original countries of migration. Every line corresponds to a stay. The objective of placing the name of the country and the continental area is to get neighboring routes closer, that is, we have introduced a neighboring effect. The analysis of correspondence is applied to this file from the point of view of the textual analysis, then the classification and the usual interpretation techniques may be used. Here two individuals are similar because they use approximately the same vocabulary, which is translated in migratory terms in that they follow approximately the same route. The results obtained that are shown in figures 7, 8 and 9 evidence the goodness of the method from the point of view of interpretation. Note particularly that in the case of the study of the survey “Colombia Networks”, the migration is discriminated in particular by the receiving countries and not by a high mobility, as it is the case in urban migrations.

Original Data I.D.	Country	From Date	To Date	Current Age
0001	Germany	1980	1985	34
0001		1986	1989	34
0001	Brazil	1990	1994	34
0002	Argentina			

Coded Data

——0001
COLOMBIA COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19
GERMANY EUROPEAN_COM GERMANY20 GERMANY13 GERMANY22 GERMANY 23
BRAZIL SOUTH_AMERICA BRAZIL26 BRAZIL27 BRAZIL28 BRAZIL29
ARGENTINA SOUTH_AMERICA ARGENTINA30 ARGENTINA31 ARGENTINA32
——0002

Figure 7. New coding of the residential migration data for textual analyses. Residential history file

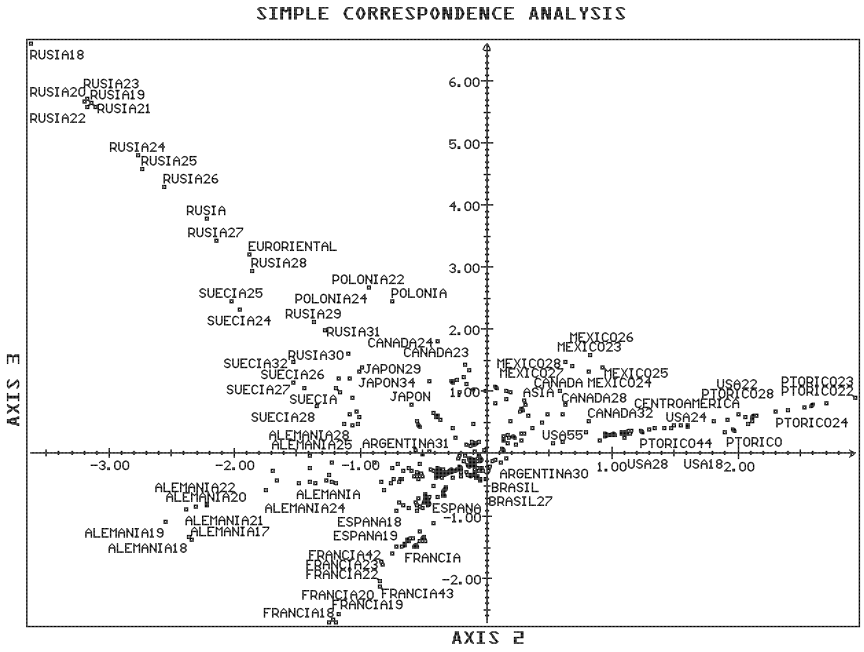


Figure 8. Sample factorial chart of residential analysis output

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CRITERE DE CLASSIFICATION — RESPONSE OU INDIVIDU CARACTERISTIQUE

6.000 -- 1 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21 COLOMBIA22
-- USA NORTAMER, USA23 USA24 USA25 USA26 USA27 USA28 USA29 USA30
-- USA31 USA32 USA33 USA34 USA35

6.000 -- 2 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21 COLOMBIA22
-- USA NORTAMER, USA23 USA24 USA25 USA26 USA27 USA28 USA29 USA30
-- USA31 USA32 USA33 USA34 USA35

5.801 -- 3 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21
-- USA NORTAMER, USA22 USA23 USA24 USA25 USA26 USA27 USA28 USA29
-- USA30 USA31 USA32 USA33

5.801 -- 4 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21
-- USA NORTAMER, USA22 USA23 USA24 USA25 USA26 USA27 USA28 USA29
-- USA30 USA31 USA32 USA33

2.747 -- 1 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21 COLOMBIA22 COLOMBIA23 COLOMBIA24 COLOMBIA25
-- ARGENTINA SURAMERICA, ARGENTINA26 ARGENTINA27 ARGENTINA28
-- ARGENTINA29 ARGENTINA30 ARGENTINA31 ARGENTINA32 ARGENTINA33
-- ARGENTINA34 ARGENTINA35 ARGENTINA36 ARGENTINA37 ARGENTINA38
-- ARGENTINA39

2.533 -- 2 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21 COLOMBIA22 COLOMBIA23 COLOMBIA24 COLOMBIA25 COLOMBIA26
-- COLOMBIA27 COLOMBIA28
-- ARGENTINA SURAMERICA, ARGENTINA29 ARGENTINA30 ARGENTINA31
-- ARGENTINA32 ARGENTINA33 ARGENTINA34 ARGENTINA35 ARGENTINA36
-- ARGENTINA37 ARGENTINA38 ARGENTINA39 ARGENTINA40 ARGENTINA41
-- ARGENTINA42 ARGENTINA43

2.504 -- 3 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21 COLOMBIA22 COLOMBIA23 COLOMBIA24 COLOMBIA25 COLOMBIA26
-- COLOMBIA27 COLOMBIA28
-- ARGENTINA SURAMERICA, ARGENTINA29 ARGENTINA30 ARGENTINA31
-- ARGENTINA32 ARGENTINA33 ARGENTINA34 ARGENTINA35 ARGENTINA36
ARGENTINA37 ARGENTINA38 ARGENTINA39 ARGENTINA40 ARGENTINA41

Figure 9. Some characteristic answers of two clusters

- Analysis of research fields

Figure 10 shows the original source of the data collected in the survey “Colombia Networks”. The purpose of this part of the study is to establish the fields in which the researchers are working. The first attempt of an analysis consisted in making a textual analysis of the key words answered by the people such as they had been adding the fields that they had answered themselves. The technique that used consisted in adding implicit information present in the answers. For this we use the classification system of the Pascal base corresponding to the research field answered. The key words were left just as they arrived. Figure 10 shows how each answer was prepared for the textual analysis (correspondence analysis). Figures 11, 12 and 13 give an output example of the textual analysis, and figures 14 and 15 give the same output for the associate words method.

Research fields

0001	CSocioEconomica	CJuridicas		CIENCIAS_POLITICAS
0003	CSocioEconomica	Economia General	EconInternacional	RELACION_INTERNAL SUDASIA
0004	CMedicaBiologia	Biologia	AnimalProducc	APICULTURA APITOXINA
0005	CSocioEconomica	EconoEnergia	NuclearEnerg	TECNOLOGIA_INDUSTR TECNOLOGIA_AVANZADA
0006	CMedicaBiologia	Biologia	VertebAnatSico	MEDICINA_VETERINARIA

Keywords

0001	AMERICA_LATINA
0001	ASIA__PACIFICO
0001	ECONOMIA_INTEGRACION
0003	CULTURA_IDENTIDAD
0003	ECONOMICO_DESARR
0003	POLITICA
0003	POLITICA_PROCESO
0003	RELACION_INTERNAL
0004	APICULTURA
0004	APITOXINA_EXTRACCION
0004	COLMENA
0004	STRESS
0005	ELECTROMEC_CONTROL
0005	ROBOTICA
0005	TECNOL_INTEGRACION
0005	TECNOLOGIA_BLANDA
0006	ANIMAL
0006	COMPORT_ANORMAL
0006	RESULTADOS_INFLUENC
0006	STRESS

Archivo para análisis

——0001

0001 CSocioEconomica CJuridicas CIENCIAS_POLITICAS
AMERICA_LATINA ASIA_PACIFICO ECONOMIA_INTEGRACION.

——0003

0003 CSocioEconomica EconomiaGeneral EconInternacional RELACION_INTERNAL SUDASIA
CULTURA_IDENTIDAD ECONOMICO_DESARR POLITICA POLITICA_PROCESO
RELACION_INTERNAL.

——0004

0004 CMedicaBiologia Biologia Animal Producc APICULTURA APITOXINA
APICULTURA APITOXINA_EXTRACCION COLMENA STRESS.

——0005

0005 CSocioEconomica EconoEnergia NuclearEnerg TECNOLOGIA_INDUSTR TECNOLOGIA_AVANZADA
ELECTROMEC_CONTROL ROBOTICA TECNOL_INTEGRACION
TECNOLOGIA_BLANDA.

——0006

0006 CMedicaBiologia Biologia VertebAnatSico MEDICINA_VETERINARIA
ANIMAL COMPORT_ANORMAL RESULTADOS_INFLUENC STRESS

Figure 10. New coding of data for analysis of research fields

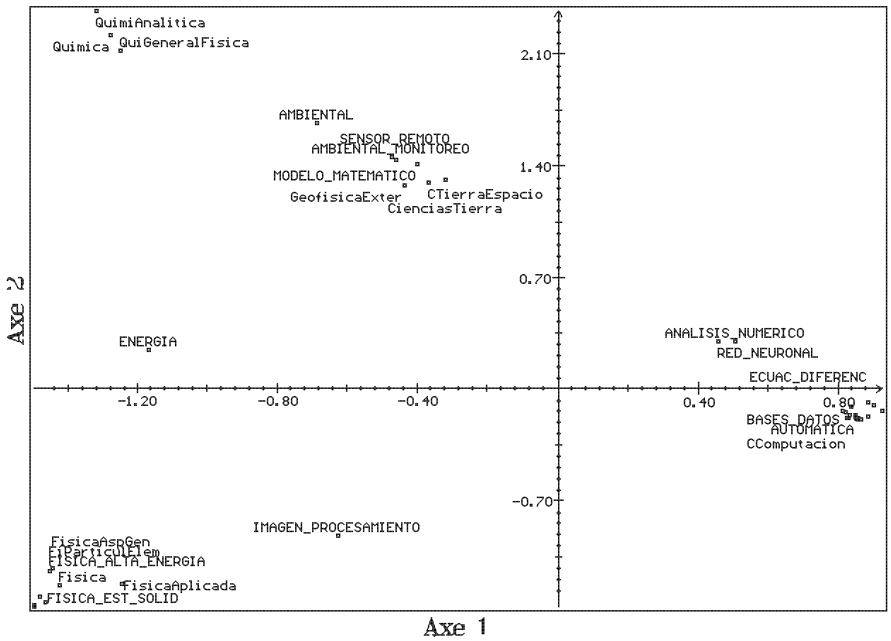


Figure 11. Example of factorial chart in the analysis of the subject of research fields Exact and Technology Sciences group

TEXTE NUMERO 6 a06a = CLASSE 6 / 13

	LIBELLE DE LA FORME GRAPHIQUE	---POURCENTAGE--- INTERNE	GLOBAL	INTERNE
1	BASES	14.29	.53	4.
2	DATOS	14.29	.80	4.
3	BASES_DATOS	10.71	.40	3.
4	MULTIMEDIA	10.71	.53	3.
5	CACienciasCompu	14.29	4.38	4.
6	MODELO	3.57	.53	1.
7	INFORMATICA	3.57	.53	1.
8	CienAplicadas	14.29	9.96	4.
2	Fisica	.00	3.19	0.
1	CExactasTecnologia	14.29	18.59	4.

Figure 12. Internal description of a research field cluster

TEXTE NUMERO 6 a06a = CLASSE 6 / 13

CRITERE DE CLASSIFICATION	REPONSE OU INDIVIDU CARACTERISTIQUE
2.168 --	1 CExactasTecnologia CienAplicadas
--	BASES_DATOS MULTIMEDIA
--	ANIMACION, BASES, DATOS, MEMORIA, MULTIMEDIA,
2.078 --	2 CExactasTecnologia CienAplicadas
--	BASES_DATOS
--	BASES, DATOS, PROTOTIPO, .
1.302 --	3 CExactasTecnologia CienAplicadas
--	BASES_DATOS
--	DEDUCTIVOS, DEPENDENCIA, MULTIVARIADA, AXIOMAS
--	INFERENCIA, BASES, DATOS, MODELO, .
1.273 --	4 CExactasTecnologia CienAplicadas
--	INFORMATICA

Figure 13. Some answers characteristics of a research cluster

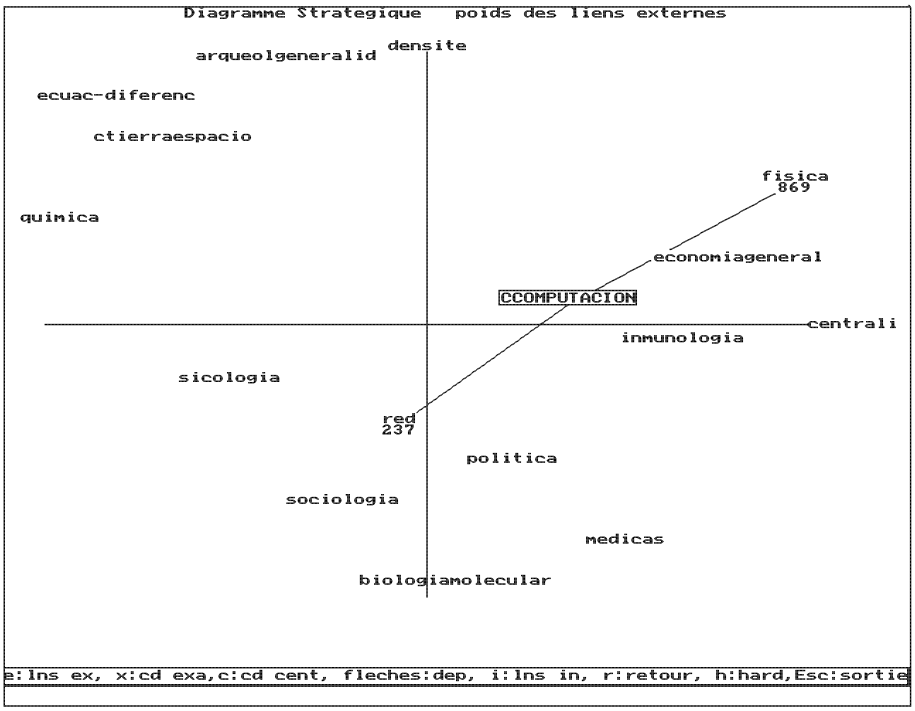


Figure 14. Example of associate words method for the research subject

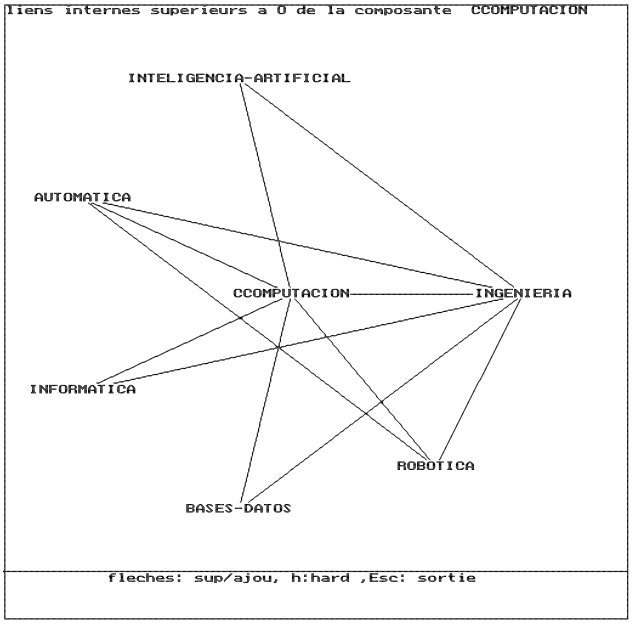


Figure 15. Example of a cluster of associate words method for research subject

Internal analysis of clusters

To discover the composition of the population by subjects is not sufficient for the researcher. The next step is to make the internal description of each cluster. From the analysis of the cluster already some distinctive features of each one may have been possibly discovered, but only the internal descriptive analysis may reveal the characteristics of each group. The graph of figure 16, for example, shows how the study within a cluster may be made, how the internal

movement is, that is, the individuals belonging to each cluster are internally typified. Other descriptive analysis will reveal for example, where they are located, what do they do, what it their idea about returning to the country, etc., of, for instance, the researchers in the area of robotics.

Conclusion

One of the great gaps that this research group has found in the review of studies in the area of scientific migrations is the non use of the modern techniques of statistical analysis, basically coming from the French school. May be the absence of an adequate bibliography which without disregarding a minimum mathematical treatment will deal with the concrete applications in the study of social sciences may be one of the main causes. The study project "The brain gain revisited through the Colombian case. Study of the Caldas Network", of which the survey "Colombia Networks" forms a part, has had a multi-disciplinary team including statisticians which has permitted to advance in a significant manner in the utilization of such tools in this type of studies, even presenting methodological proposals. The purpose of these notes has been to present an advance of the methodology which has been successfully applied in the project.

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[1] This research project is developed by agreement between the institutions Universidad Nacional de Colombia, Universidad del Valle and Institut Français de Recherche pour le Developpement en Coopération-ORSTOM with the support from Colciencias and Icfes.

[2] The Caldas Network was established by Colciencias with the purpose of being the Colombian network of researchers and professionals abroad. The objective of Colciencias by creating it was to encourage the active cooperation of the Colombian scientific and professional community living abroad in the specialized work of the groups of national researchers, opening the possibility for them to join research projects underway or promoting their participation in new ones, as well as to the country's restructuring process which was initiated by President Gaviria. The network forms a part of the special strategies formulated within the national science and technology plan formulated during the Gaviria government, within the item "promotion of groups and networks", leading to the formation of a scientific community.

Perspectivas de análisis estadístico en el estudio de migraciones de científicos y profesionales

Alvaro Montenegro

Introducción

Se presenta el proceso metodológico seguido para llevar a cabo la encuesta “Redes Colombia”, dentro del marco del proyecto de investigación “El brain gain revisited a través del caso colombiano. Estudio de la Red Caldas ” [1]. El objetivo del proyecto es hacer un análisis profundo de la población de investigadores colombianos expatriados, organizados principalmente alrededor de la red Caldas [2]. La encuesta fue enviada a los investigadores colombianos expatriados que este grupo de investigación localizó en 24 países. Se emplearon diferentes medios de envío de la encuesta, entre ellos principalmente el correo aéreo y el correo electrónico.

Las herramientas

El análisis estadístico de la información recolectada, requiere al menos de la utilización de las siguientes herramientas.

Sistema de base de datos

El costos del lanzamiento y recolección de información en una encuesta internacional es bastante elevado, por lo que la información recolectada debe ser suficientemente amplia, de manera que se aproveche al máximo el esfuerzo que se hace. Esto implica que la encuesta tendrá información de muy variado tipo y para los análisis se requerirán reportes complejos. Entonces es indispensable construir de una manera técnica una base de datos normalizada para almacenar la información. La información debe entrar de una vez codificada a la base de datos, por lo que será necesario utilizar tablas de clasificación estándar. En el caso de la encuesta “Redes Colombia”, se utilizaron tablas de disciplinas de la UNESCO, y el sistema de clasificación de la base Pascal, para la codificación de datos de escolaridad, campos de investigación y actividades laborales.

Lenguaje de programación

La experiencia nos ha demostrado que a pesar de contar con una sofisticada base de datos, y de tener experiencia en su uso, la preparación de los datos para los análisis estadísticos, des-

pués de que salen de la base de datos es en muchos casos muy compleja. Según la clase de análisis que se requiera, los datos deben reorganizarse y recodificarse, antes de ingresar a la herramienta estadística.

Hoja electrónica

La hoja electrónica moderna es de invaluable ayuda para la manipulación de la información. Los mejores gráficos estadísticos pueden obtenerse de esta herramienta. Adicionalmente buena parte del trabajo de recodificación y reorganización de los datos puede hacerse con la herramienta.

Herramientas estadísticas

La elección de la herramientas estadísticas depende del tipo de análisis que requieran. En los estudios sociales, lo mas recomendado es utilizar las herramientas basadas en las técnicas del análisis de datos. Como se discute en la sección 2 el propósito del enfoque francés del análisis de datos es descubrir y describir las características presentes en una población, en contraposición con los métodos paramétricos, cuyo propósito es modelar y luego probar.

Las técnicas

Además de las técnicas del análisis descriptivo, las técnicas del análisis de datos son las más indicadas para los estudios sociales. Para el análisis de la encuesta “Redes Colombia se han utilizado las siguientes técnicas del análisis de datos.

Análisis de Correspondencia Simple (ACS)

Mediante esta técnica es posible comparar 2 variables categóricas. En el ACS se construyen perfiles de respuesta a partir de la matriz de cruce de las dos variables, y su propósito es encontrar un espacio en el cual la inercia total de los datos pueda ser descompuesta a o lo largo de los nuevos ejes únicamente. La matriz de datos inicial es de tamaño n*m, en donde n y m son respectivamente el número de categorías de cada variable, y el elemento ij de la matriz es el número de individuos que presentan simultáneamente las categorías i de la primera variable y j de la segunda variable. En los cálculos se utiliza la distancia chi-cuadrado, que tiene la característica de darle menos peso a las categorías mas frecuentes, y mas peso a las menos frecuentes, las cuales precisamente por su baja frecuencia son las que determinan el análisis. El resultado final es la obtención de planos (planos factoriales) en los cuales se pueden apreciar las relaciones entre unas categorías y otras, teniendo en cuenta los siguientes principios de interpretación.

Las dos variables pueden ser representadas simultáneamente en el mismo plano factorial. Las modalidades mas frecuentes quedan representadas cerca del nuevo origen coordenado. Estas son las características comunes de la población. Las modalidades menos frecuentes aparecen alejadas del origen. Estas son las características que diferencian a la población.
Las modalidades que aparecen relativamente cerca entre sí son características de un mismo grupo de individuos y por tanto lo caracterizan.

La posición de una modalidad cualquiera i (respectivamente j) en un plano factorial es el baricentro de todas las modalidades j (respectivamente i) de la otra variable que fueron seleccionadas simultáneamente con la modalidad i (respectivamente j) en las respuestas de la encuesta. Modalidades adicionales (que serán explicativas) pueden proyectarse en el plano factorial con el objeto de completar la caracterización de los grupos presentes en la población.

Análisis de Correspondencia Múltiple (ACM)

El ACM es la extensión natural de ACS, para analizar simultáneamente múltiples variables. La matriz inicial para los análisis es ahora una matriz n*p, en donde n es el tamaño de la muestra y p el número total de categorías presentes, incluyendo todas las variables para las cuales se hará el análisis. El objetivo del ACM es el mismo que en el ACS, es decir, se busca encontrar un espacio en el cual la inercia de la nube de puntos se descomponga totalmente a lo largo de los nuevos ejes coordenados. La distancia chi - cuadrado es también utilizada y tiene los mismos efectos que antes. Los principios de interpretación son similares al ACS, teniendo en cuenta que en este caso el origen de los planos factoriales es el baricentro de todas las categorías.

Análisis de datos textuales

Es la técnica de análisis de datos mas reciente. Se deriva de ACS, con la característica de que se adapta para el manejo de enormes matrices muy dispersas. Esta técnica fue desarrollada para el análisis de textos literarios y en particular para el análisis a preguntas abiertas de encuestas. La base del método esta en la creación de la variable léxica cuyas categorías son cada una de las palabras diferentes presentes en los textos. La matriz para los análisis es por lo general una matriz n*p en donde n es el número de textos y p el número de categorías de la variable léxica, y el análisis es un ACS. En el estudio de la encuesta “Redes Colombia” se ha encontrado que la herramienta puede ser utilizada con éxito en el análisis de información biográfica y en la obtención de cartas científicas a partir de palabras clave.

Análisis de clases

.Las tres técnicas anteriores son lo bastante descriptivas como para que con alguna experiencia el investigador pueda forjarse una idea de lo que sucede en al población, a partir de la observación directa de diferentes planos factoriales. Sin embargo para tener una descripción rigurosa de la población estudiada es necesario hacer procesos de clasificación (cluster analysis), sobre los datos a partir de sus ubicaciones en los planos factoriales. Este proceso permite al final describir la población tal y como es sin perder la realidad multivariante presente en los datos.

Análisis de palabras asociadas

Esta técnica proviene de la cienciometría y es utilizada para el análisis de los contenidos de un corpus de datos documentales que son construidos a partir de palabras que son usadas para indexar los documentos originales.

La base del método es el cálculo del coeficiente de asociación entre dos palabras. Sean i, j dos palabras del corpus.

El coeficiente de asociación entre i y j se define por

$$E_{ij} = \left(\frac{c_{ij}}{c_i}\right)\left(\frac{c_{ij}}{c_j}\right)$$

en donde c_i y c_j son las frecuencias de las palabras i y j respectivamente en todo el corpus, y c_{ij} es la frecuencia de coocurrencia de las palabras i y j en un mismo texto.

El coeficiente de asociación es calculado para todas las parejas de palabras que tienen una frecuencia mayor que un umbral. A partir de los coeficientes de asociación se efectua una clasificación, y se obtienen grupos de palabras. Cada grupo determina una temática presente en el corpus.

A continuación se calculan dos índices para cada grupo. El índice de centralidad y el índice de densidad. El índice de centralidad de un grupo de palabras es la media de los índices de asociación entre las palabras del grupo y las palabras de otros grupos. Es decir, es in índice de relación entre grupos. Una temática es mas central si está mas relacionada con las demás. El índice de densidad es la media de los coeficientes de asociación dentro de un grupo. Una temática es más densa si tiene un mayor desarrollo. Estos índices permiten construir un diagrama estratégico en dos dimensiones, cruzando los índices de centralidad (primer eje) y densidad (segundo eje) de cada uno de los grupos. El origen del diagrama es la mediana de los índices de centralidad y densidad respectivamente. El diagrama se compone de cuatro cuadrantes que pueden ser interpretados.

- El primer cuadrante (mayor centralidad, mayor densidad) presenta las temáticas desarrolladas, la temáticas de referencia.
- El segundo cuadrante (menor centralidad, mayor densidad) presenta las temáticas desarrolladas con poca influencia global.
- El tercer cuadrante (menor centralidad, menor densidad) presenta las nuevas temáticas, las temáticas nacientes.
- El cuarto cuadrante (mayor centralidad, menor densidad) presenta las temáticas en desarrollo, las temáticas puente, las temáticas prometedoras.

Los tipos de datos

Los tipos de datos de la encuesta deben ser cuidadosamente definidos antes de diseñar la encuesta y deben corresponder a los propósitos de la investigación. En el caso de la encuesta “Redes Colombia”, se busca en general describir la situación de la diáspora identificada de investigadores colombianos expatriados, en términos de :

Datos sociodemográficos

Edad, sexo, nacionalidad (es) del encuestado y sus familiares cercanos, escolaridad, actividad actual.

Datos biográficos

Trayectoria residencial
Trayectoria académica
Trayectoria laboral.

Datos de campos de investigación

Campos y palabras clave que describen los contenidos de las investigaciones.

Datos factuales

Tipo de relaciones activas que se tienen con Colombia
Tipo de entidad en la que se trabaja
Medios de comunicación que se utilizan
Pertenencia a redes de asociación de colombianos.

Datos de opinión

Nivel de satisfacción y expectativas frente al trabajo actual
Beneficios y aportes esperados respecto a la red Caldas
Condiciones de favorabilidad y dificultad para establecer relaciones activas con Colombia
Aciertos y problemas de la red Caldas, evolución de la ciencia y tecnología en Colombia (preguntas abiertas).

Datos de publicaciones

Referencias de las publicaciones.

La metodología

La figura 1. muestra el proceso metodológico que se ha seguido en la encuesta "redes Colombia". La metodología es aplicable a cualquier estudio de este tipo. Cada uno de los pasos se describe a continuación.

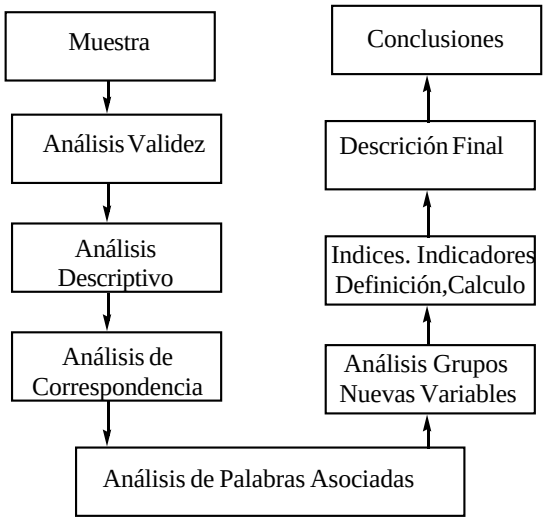


Figura 1. Esquema de la metodología para el análisis estadístico de migraciones científicas y profesionales

La muestra

En un tipo de encuesta como la encuesta "Redes Colombia", es muy improbable que pueda hacerse un muestreo siguiendo alguno de los modelos de muestreo tradicionales por las siguientes razones :

No se tiene una marco muestral completo.
No es posible entrevistar directamente a los encuestados.
No se tiene certeza de ubicar a cada individuo, debido a su movilidad.
La probabilidad de respuesta no es la misma en cada país.
El objeto de estudio es muy dinámico.

Las encuestas para el estudio de las migraciones científicas y profesionales deben ser enviadas a diferentes partes del mundo. La fuente primaria de información para ubicar a los individuos a ser estudiados se encuentra en los archivos gubernamentales los cuales son por lo general incompletos, y no están siempre actualizados. Entonces nuevas fuentes deben ubicarse, de tal manera que sea posible encontrar otros individuos y así aumentar el marco. Para la encuesta "Redes Colombia", se partió de la base de datos de Colciencias, entidad que orienta la políticas de ciencia y tecnología en Colombia, en la cual se encontraban registrados y totalmente identificados 826 investigadores y profesionales colombianos en exterior, en el año de 1994. Nuevas personas fueron ubicadas gracias a información recibida de algunos encuestados, y otros a partir de listas construidas por coordinadores de la red Caldas en los diferentes países.

La metodología para la obtención de la muestra, debe tener en cuenta, las dificultades mencionadas arriba, con el objeto de garantizar hasta donde sea posible la confiabilidad de los resultados obtenidos. Los pasos que se proponen son :

Decidir el número de formularios a enviar

Con la información disponible sobre ubicaciones de las personas, se debe decidir, de acuerdo al presupuesto disponible, cuál será el número de formularios enviados, y cuál la forma de envío. Debe utilizarse toda la información disponible, con el objeto de obtener una muestra que sea realmente significativa de la población estudiada.

Una estimación previa de algunos parámetros resulta de utilidad para la toma de decisiones antes del envío y después de la recepción de los formularios. La hipótesis que puede manejarse por ejemplo es que la base datos gubernamental constituye una buena muestra de la población estudiada. Si esto se asume, entonces es posible hacer para el caso de las migraciones científicas y profesionales las siguientes estimaciones :

Se considera la población distribuida geográficamente, por lo que se puede suponer un modelo multinomial, en donde cada categoría es una país receptor. Entonces es posible estimar la proporción de individuos en cada país. Nótese, que no es posible establecer intervalos de confianza, debido a que se desconoce el tamaño de la población.
Si se tiene alguna información adicional, como por ejemplo el área de trabajo, investigación, escolaridad, etc. puede usarse adicionalmente. Por ejemplo en el caso de estudio "Redes Colombia", se disponía de la clasificación a partir de los programas de investigación de Colciencias. Esta información adicional permite estimar parámetros de interés para el estudio. Para el caso de las migraciones científicas es más importante que la muestra sea muy representativa de las área científicas, aunque se aleje un poco (aunque no mucho) de la distribución geográfica.

Recibir la encuestas y almacenar los datos

Toda la información proveniente de las encuestas debe almacenarse en la base de datos construida para tal fin. La figura 2. Presenta el menú principal de la base de datos de la encuesta "Redes Colombia".

Análisis de la validez y representatividad de la encuesta

Es el primer paso importante del análisis estadístico y no puede ser omitido. Del resultado de éste análisis dependerá si debe tomarse una submuestra o dar pesos diferentes a algunos individuos. Además debe indicar si las conclusiones son realmente aplicables a toda la población bajo estudio. Dentro del estudio de la encuesta "Redes Colombia" se hicieron las pruebas de bondad de ajuste chi-cuadrado que se describen a continuación.

BASE DE DATOS

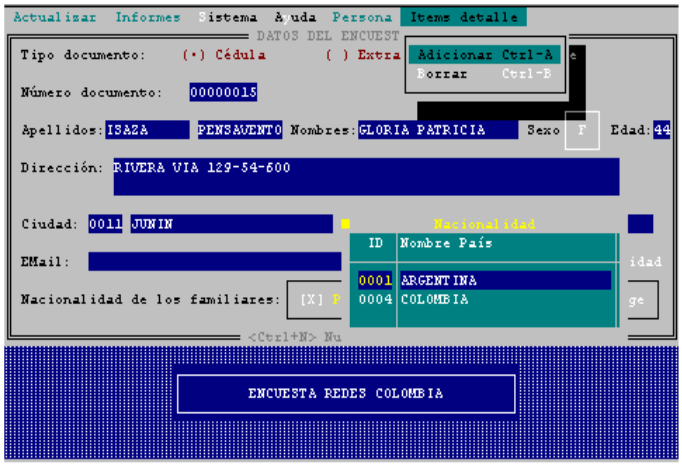


Figura 2. Menú principal de encuesta “Redes Colombia”

Se comparó la distribución de envio por países y la distribución de recepción. La distribución de la muestra se ajusta a la de envío. La figura 3 muestra la comparación de distribuciones.

Se comparó la distribución por países de la base de datos de Colciencias y la submuestra resultante de las encuestas obtenidas a partir de la base de datos de Colciencias. La submuestra ajustó perfectamente. La figura 3 muestra la comparación.

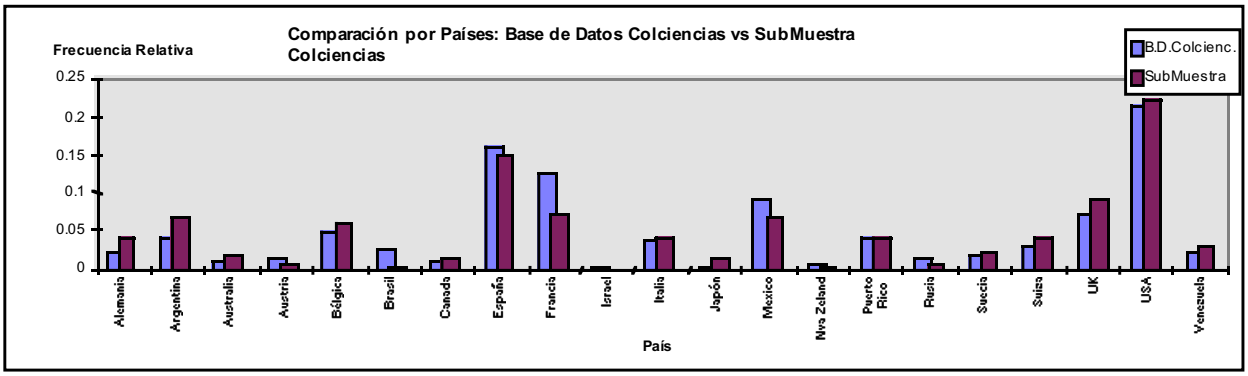
Se comparó la distribución por programas de investigación de la submuestra resultante de las encuestas obtenidas a partir de la base de datos de Colciencias, con los parámetros de Colciencias con resultado positivo.

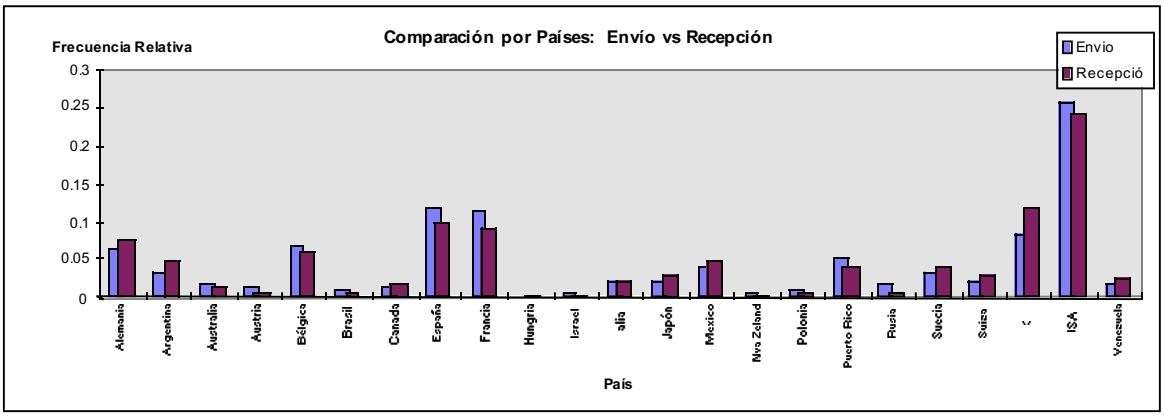
Se verificó la cuasi-independencia de respuesta dentro de cada país, comparando la distribución, por programas de investigación para la muestra y submuestra respectivamente. En el caso de la muestra total solo en dos países, los parámetros no ajustaron bien. En estos caso tenemos mas individuos ubicados, provenientes de fuentes diferentes a Colciencias.

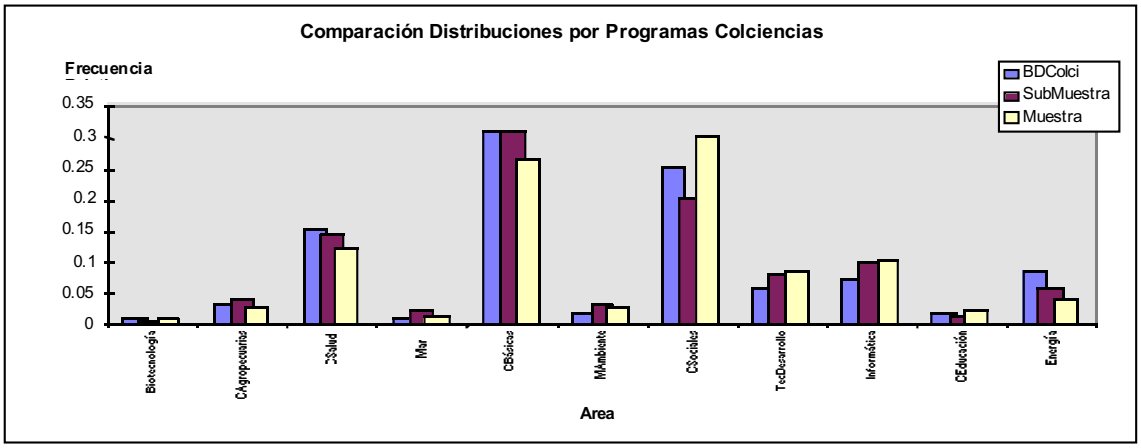
La conclusión es que la muestra es muy representativa de la población estudiada, y como el estudio es principalmente descriptivo (exploratorio) es posible continuar con el siguiente paso del análisis sin ninguna modificación. La figura 3. muestra la comparación de las distribuciones por programas de investigación de la muestra total y de la base de datos de Colciencias de 1994, en la encuesta “Redes Colombia”, en general, y la comparación interna dentro de Estados Unidos. Finalmente es necesario entender que los resultados obtenidos deben ser interpretados como tendencias presentes en la población y no como parámetros.

Primer análisis descriptivo

Este primer paso es necesario para tener una primera impresión de las características globales de la población así sea de forma aislada. Algunas primeras conclusiones pueden obtenerse desde ya. Por ejemplo es posible decir que la población examinada en la encuesta “Redes Colombia” esta conformada en 69 % por hombres, que la mayor parte de la población distribuye su tiempo entre el trabajo y la investigación (35 %) y entre el estudio y la investigación (25 %). Que el 87 % de la población encuestada tiene que ver con procesos de investigación, ya sea como estudiantes de maestría y doctorado o como investigadores de profesión, que el 83 % tiene un nivel de escolaridad entre maestría y doctorado, que las migraciones laborales mas frecuentes ocurren entre los países de Estados Unidos, Francia, España, Inglaterra, México, Alemania, Argentina, Brasil,







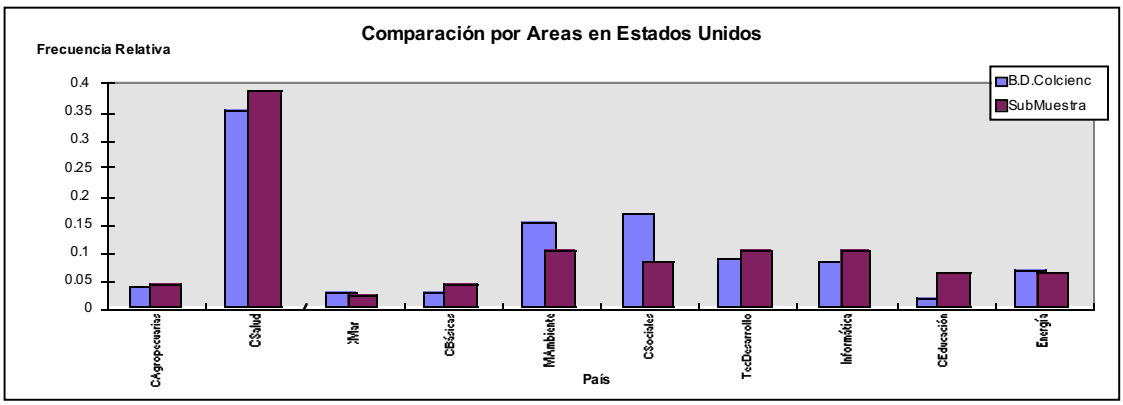
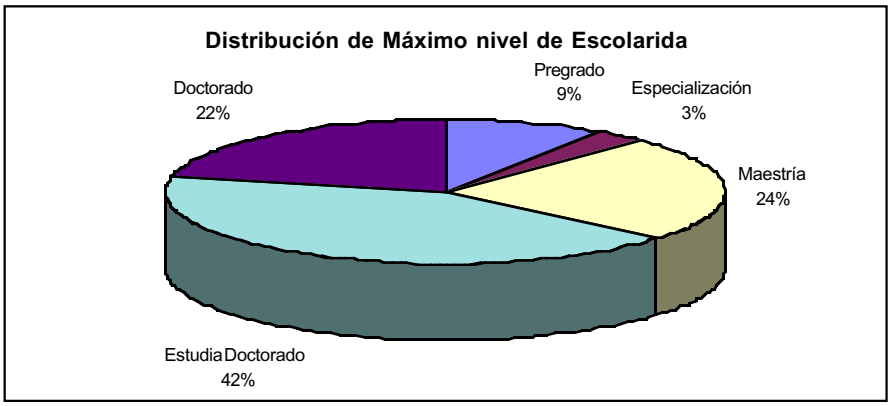


Figura 3. Análisis de la muestra de la encuesta “Redes Colombia”. Comparación de distribuciones

Venezuela, y obviamente Colombia. Que la mayor parte de las personas migran por primera vez por razones escolares, etc.... Esta información de hecho es útil para algunas tomas de decisión. De hecho puede ser información estratégica para algunas entidades. Para nosotros constituye en realidad el primer contacto con los datos. La figura 4 muestra dos ejemplos.



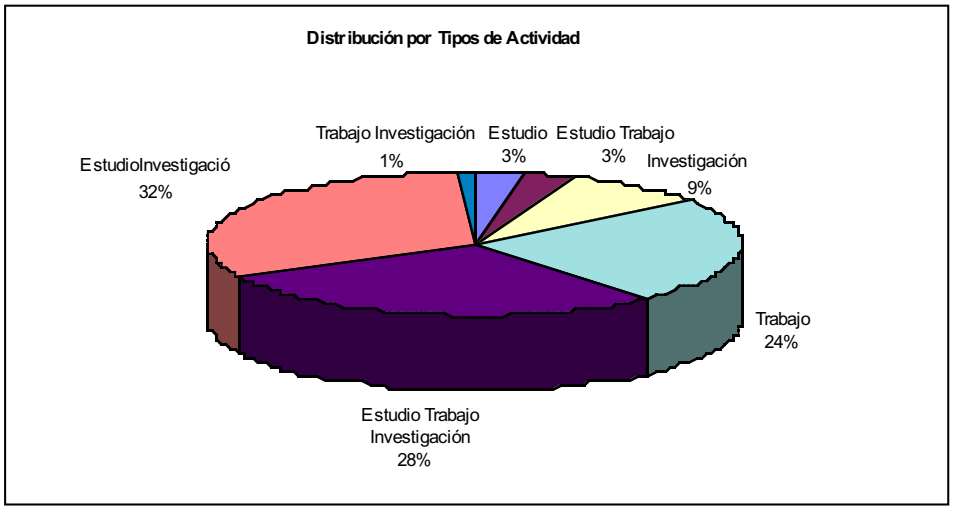


Figura 4. Ejemplos de análisis descriptivos

Primeros análisis de datos por temas (Primera clasificación de los datos), algunos ejemplos

Este paso es de los más complejos. Es el paso en donde será necesario hacer recodificaciones, reportes de diferente forma, etc.

El propósito es avanzar por temas en el análisis. Cada tema identificado es tratado en forma separada, No es mejor análisis aquel que se hace juntando todas las variables, entre otras cosas, por que cada tema por sí mismo requiere de atención y posiblemente tratamiento diferenciado. En el caso de la encuesta “Redes Colombia”, se llevaron a cabo entre otros algunos de los análisis cuyos resultados y aspectos más importantes se anotan a continuación. Se han escogido solo unos pocos ejemplos.

Análisis sociodemográfico

Se incluyeron las variables sociodemográficas, con la idea de establecer una clasificación de la población desde este punto de vista. El resultado obtenido es que toda la población es muy homogénea y con la excepción de los lazos familiares que ligan a algunos de los encuestado con el país de residencia, las demás características son comunes a la mayoría de la población.

Relaciones activas con Colombia

Se utilizaron 14 variables, con un total de 10 categorías. Las variables se sometieron a un ACM, cuyo primer plano factorial es mostrado en la figura 5. El análisis parece mostrar la existencia de cuatro grandes grupos. Unos que mantienen relaciones formales, otros que mantienen relaciones temporales, y otros que no mantienen relaciones con Colombia, y una clase de no respuesta. El análisis de clases confirma esta sospecha y además la proyección de las variables sociodemográficas ayuda a encontrar algunas características distintivas adicionales de cada grupo. En el próximo paso cada uno de las clases debe ser analizado a fondo. Por lo pronto ha bastado con identificar los grupos y tener una primera descripción de cada uno. El paso final en esta parte es crear una nueva variable, la variable Relaciones Activas, con cuatro categorías, cada una asociada a uno de las clases resultantes. La figura 6 presenta la descripción de uno de las clases. Ambas salidas provienen del programa estadístico, luego del ACM y de la clasificación respectivamente.

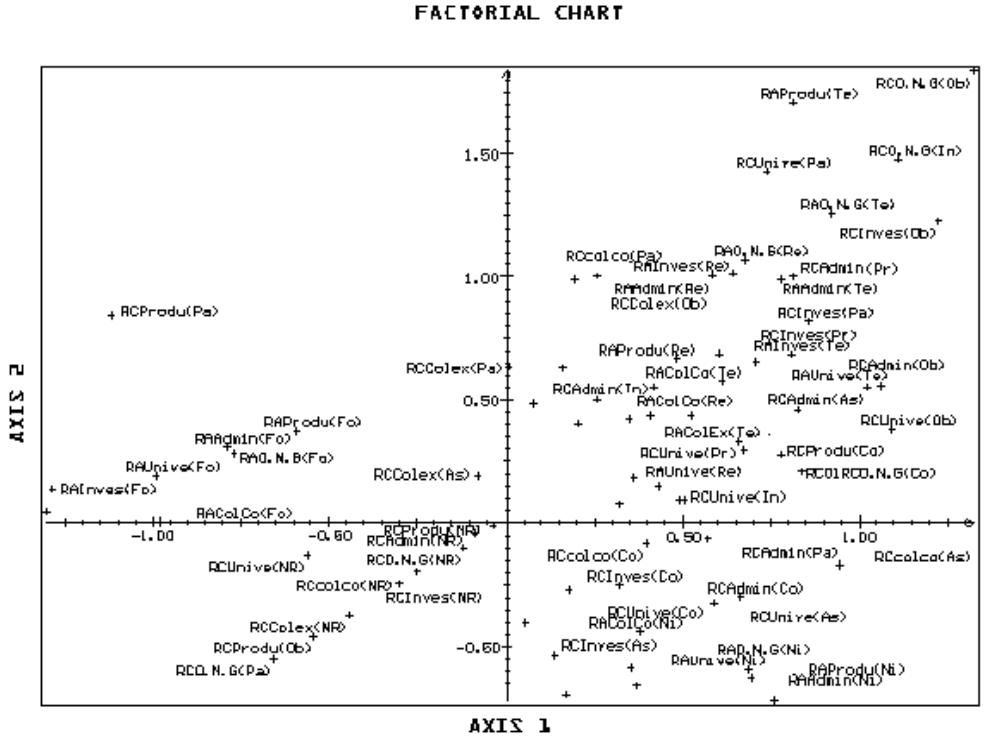


Figure 5. Plano factorial del tema relaciones activas s con Colombia (14) Variables

GLOBAL CHARACTERISTIC					
V.TEST	PROB.	PERCENTS	CLAS/MOD	MOD/CLAS.	MODALITY
8.54	.000	66.67	46.67	9.27	RAColCo(Re)
8.23	.000	84.00	35.00	5.52	RAInves(Re)
7.86	.000	51.67	51.67	13.25	RCUnive(Pr)
7.45	.000	52.83	46.67	11.70	RAUnive(Re)
6.43	.000	68.00	28.33	5.52	RAAdmin(Re)
5.92	.000	36.71	48.33	17.44	RAColEx(Re)
5.10	.000	47.22	28.33	7.95	RCInves(Pr)
4.64	.000	41.46	28.33	9.05	Rccolco(Pr)
4.33	.000	72.73	13.33	2.43	RAO.N.G(Re)
3.86	.000	23.66	51.67	28.92	RCColex(Pr)
2.96	.002	35.71	16.67	6.18	fisica
2.39	.009	45.45	8.33	2.43	RCAdmin(In)
- 2.41	.008	8.96	31.67	46.80	RAAdmin(Fo)
- 2.43	.008	11.66	78.33	88.96	RCAdmin(NR)
- 2.53	.006	2.04	1.67	10.82	pregrado

Figura 6. Descripción de la clase 2 del tema relaciones activas con Colombia La lista superior son las características dominantes y la lista inferior son las características mas alejadas

Análisis de migración residencial

Técnicas recientes como el análisis armónico cualitativo han sido desarrolladas aunque no implementadas completamente en un programa estadístico, para el análisis de trayectorias migratorias. Dentro del análisis de la encuesta "Redes Colombia" se ha utilizado con éxito una estrategia basada en el análisis de datos textuales, la cual describimos a continuación por constituir un aporte metodológico para este tipo de problemas. Para el estudio de datos longitudinales, la estrategia "tradicional" que se ha seguido es la siguiente : primero se discretiza el tiempo, definiendo periodos (que pueden ser históricos o de edad de la población encuestada), y agrupando los sitios de destino de acuerdo a algún criterio. En seguida se cruzan las dos variables tiempo discretizado por grupos destino obteniendo una variable de estado en donde cada modalidad es un espacio temporal por una espacio geográfico. A cada categoría se asocia el porcentaje de permanencia en tal estado para cada individuo, obteniendose una matriz de individuos por estados, la cual es sometida al análisis de correspondencia, y luego a la clasificación. Las técnicas de interpretación habituales son entonces utilizadas.

La técnica de análisis de datos textuales ha sido utilizada en algunos estudios aunque según nuestro criterio en forma errónea. Lo que nosotros hemos hecho es recodificar los datos como se muestra en la figura 7. Es decir hemos supuesto para cada individuo una respuesta textual de la forma

País1 Area_Continental_1 pais1_edad1 pais1_edad2...
País2 Area_Continental_2 pasi2_edad1 pais2_edad_2...

Datos originales I.D.	País	Fecha	Fecha	Edad
0001 0001 0002	Alemania Brasil Argentina	1980 1986 1990	1985 1989 1994	34 34 34
Datos codificados				
——0001 COLOMBIA COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 ALEMANIA COM_EUROPEA ALEMANIA20 ALEMANIA13 ALEMANIA22 ALEMANIA 23 BRASIL SUR_AMÉRICA BRASIL26 BRASIL27 BRASIL28 BRASIL29 ARGENTINA SUR_AMÉRICA ARGENTINA30 ARGENTINA31 ARGENTINA32 ——0002				

Figura 7. Recodificación de los datos de migración residencial para los análisis textuales
Archivo de historia residencial

Es decir hemos escrito toda la historia residencial año por año en los países originales de migración. Cada línea corresponde a una estadía. El objetivo de colocar el nombre del país y el área continental es el de acercar trayectorias vecinas, es decir hemos introducido un efecto de vecindad. A este archivo se aplica el análisis de correspondencia desde el punto de vista del análisis textual, luego la clasificación y las técnicas del interpretación usuales pueden emplearse.

Aquí dos individuos se parecen porque usan aproximadamente el mismo vocabulario, lo que se traduce en término migratorios como que siguen aproximadamente las misma trayectoria. Los resultados obtenidos que se muestran en las figuras 7, 8 y 9 demuestran las bondades del método desde el punto de vista de la interpretación. Nótese en particular que en el caso de estudio de la encuesta "Redes Colombia", la migración se discrimina principalmente por los países receptores y no por una alta movilidad, como ocurre en las migraciones urbanas.

Análisis de biografías laborales y académicas

Se usado una mezcla de la técnica anterior y de la próxima. Por problemas de tiempo no alcanzamos a describir en detalle.

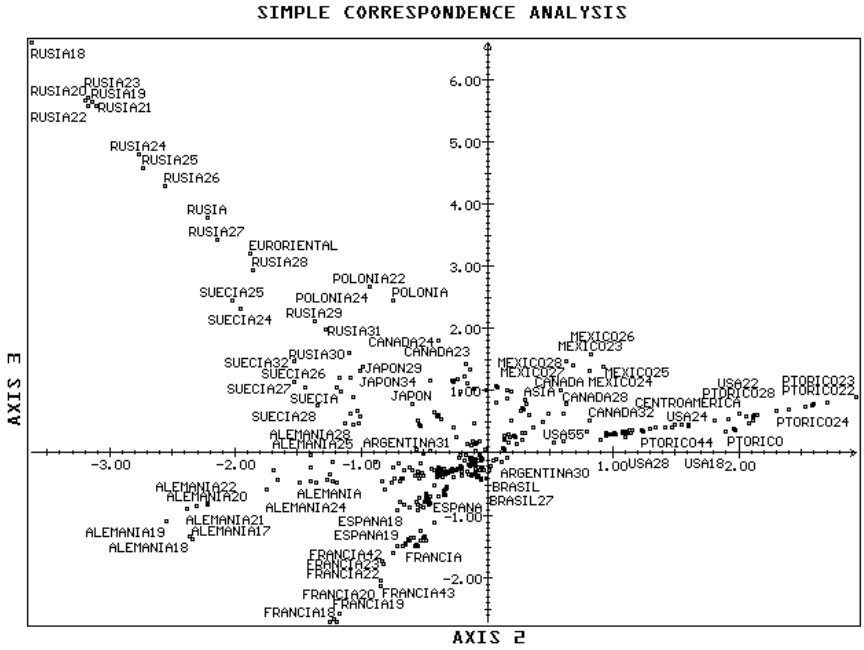


Figura 8. Plano factorial ejemplo de salida de análisis residencial

---

CRITERIO DE CLASIFICACÓN — RESPUESTA O INDIVIDUO CARACTERÍSTICO

6.000 -- 1 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21 COLOMBIA22
-- USA NORTAMER, USA23 USA24 USA25 USA26 USA27 USA28 USA29 USA30
-- USA31 USA32 USA33 USA34 USA35
6.000 -- 2 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21 COLOMBIA22
-- USA NORTAMER, USA23 USA24 USA25 USA26 USA27 USA28 USA29 USA30
-- USA31 USA32 USA33 USA34 USA35
5.801 -- 3 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21
-- USA NORTAMER, USA22 USA23 USA24 USA25 USA26 USA27 USA28 USA29
-- USA30 USA31 USA32 USA33
5.801 -- 4 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21
-- USA NORTAMER, USA22 USA23 USA24 USA25 USA26 USA27 USA28 USA29
-- USA30 USA31 USA32 USA33
2.747 -- 1 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21 COLOMBIA22 COLOMBIA23 COLOMBIA24 COLOMBIA25
-- ARGENTINA SURAMERICA, ARGENTINA26 ARGENTINA27 ARGENTINA28
-- ARGENTINA29 ARGENTINA30 ARGENTINA31 ARGENTINA32 ARGENTINA33
-- ARGENTINA34 ARGENTINA35 ARGENTINA36 ARGENTINA37 ARGENTINA38
-- ARGENTINA39
2.533 -- 2 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21 COLOMBIA22 COLOMBIA23 COLOMBIA24 COLOMBIA25 COLOMBIA26
-- COLOMBIA27 COLOMBIA28
-- ARGENTINA SURAMERICA, ARGENTINA29 ARGENTINA30 ARGENTINA31
-- ARGENTINA32 ARGENTINA33 ARGENTINA34 ARGENTINA35 ARGENTINA36
-- ARGENTINA37 ARGENTINA38 ARGENTINA39 ARGENTINA40 ARGENTINA41
-- ARGENTINA42 ARGENTINA43
2.504 -- 3 COLOMBIA16 COLOMBIA17 COLOMBIA18 COLOMBIA19 COLOMBIA20
-- COLOMBIA21 COLOMBIA22 COLOMBIA23 COLOMBIA24 COLOMBIA25 COLOMBIA26
-- COLOMBIA27 COLOMBIA28
-- ARGENTINA SURAMERICA, ARGENTINA29 ARGENTINA30 ARGENTINA31
-- ARGENTINA32 ARGENTINA33 ARGENTINA34 ARGENTINA35 ARGENTINA36
ARGENTINA37 ARGENTINA38 ARGENTINA39 ARGENTINA40 ARGENTINA41

Figura 9. Algunas respuestas características en dos clases

Análisis de campos de investigación

La figura 10 muestra la fuente original de los datos recolectados en la encuesta “Redes Colombia”. El propósito de esta parte del estudio es establecer los campos en los cuales los investigadores se encuentran trabajando. La técnica que empleada consiste en agregar información implícita presente en la respuestas. Para ello utilizamos el sistema de clasificación de la base Pascal. Concretamente los que hicimos fue agregar a la respuesta los tres primeros campos de la base Pascal correspondientes al campo de investigación respondido. Las palabras clave se dejaron tal como llegaron. La figura 10 muestra como se preparó cada respuesta para el análisis textual (análisis de correspondencia) y para el análisis de contenido (palabras asociadas). Las figuras 11, 12 y 13 muestra un ejemplo de salida del análisis textual, y las figuras 14 y 15 muestran las mismas salidas por el método de palabras asociadas.

Campos de Investigación

0001	CSocioEconomica	CJuridicas		CIENCIAS_POLITICAS
0003	CSocioEconomica	Economia General	EconInternacional	RELACION_INTERNAL SUDASIA
0004	CMedicaBiologia	Biologia	AnimalProducc	APICULTURA APITOXINA
0005	CSocioEconomica	EconoEnergia	NuclearEnerg	TECNOLOGIA_INDUSTR TECNOLOGIA_AVANZADA
0006	CMedicaBiologia	Biologia	VertebAnatSico	MEDICINA_VETERINARIA

Palabras clave

0001	AMERICA_LATINA
0001	ASIA__PACIFICO
0001	ECONOMIA_INTEGRACION
0003	CULTURA_IDENTIDAD
0003	ECONOMICO_DESARR
0003	POLITICA
0003	POLITICA_PROCESO
0003	RELACION_INTERNAL
0004	APICULTURA
0004	APITOXINA_EXTRACCION
0004	COLMENA
0004	STRESS
0005	ELECTROMEC_CONTROL
0005	ROBOTICA
0005	TECNOL_INTEGRACION
0005	TECNOLOGIA_BLANDA
0006	ANIMAL
0006	COMPORT_ANORMAL
0006	RESULTADOS_INFLUENC
0006	STRESS

Archivo para análisis

——0001
0001 CSocioEconomica CJuridicas CIENCIAS_POLITICAS
AMERICA_LATINA ASIA_PACIFICO ECONOMIA_INTEGRACION.
——0003
0003 CSocioEconomica EconomiaGeneral EconInternacional RELACION_INTERNAL SUDASIA
CULTURA_IDENTIDAD ECONOMICO_DESARR POLITICA POLITICA_PROCESO
RELACION_INTERNAL.
——0004
0004 CMedicaBiologia Biologia Animal Producc APICULTURA APITOXINA
APICULTURA APITOXINA_EXTRACCION COLMENA STRESS.
——0005
0005 CSocioEconomica EconoEnergia NuclearEnerg TECNOLOGIA_INDUSTR
TECNOLOGIA_AVANZADA
ELECTROMEC_CONTROL ROBOTICA TECNOL_INTEGRACION
TECNOLOGIA_BLANDA.
——0006
0006 CMedicaBiologia Biologia VertebAnatSico MEDICINA_VETERINARIA
ANIMAL COMPORT_ANORMAL RESULTADOS_INFLUENC STRESS

Figura 10. Recodificación de los datos para el análisis de campos de investigación

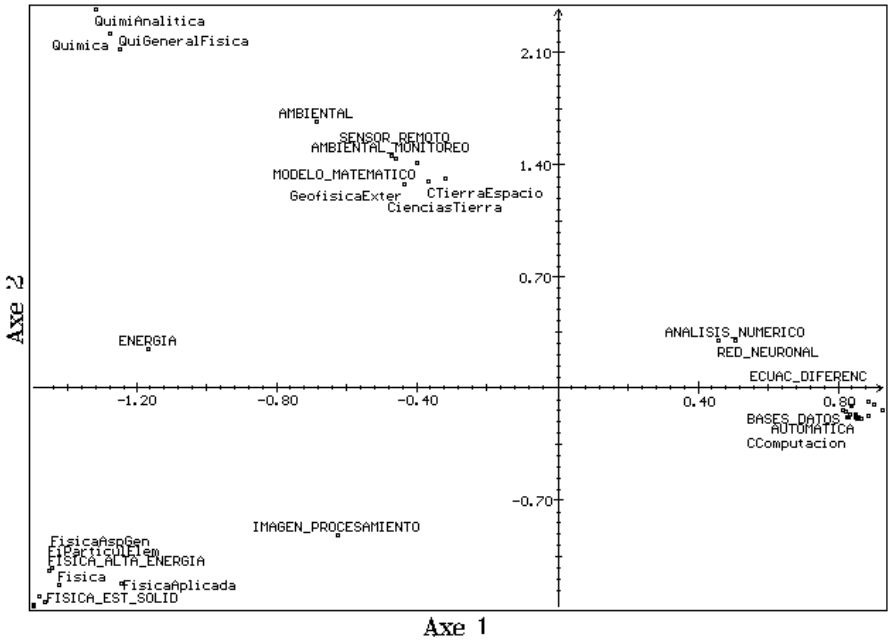


Figura 11. Ejemplo de plano factorial en el análisis del tema campos de investigación. Grupo Ciencias Exáctas y tecnológicas

TEXTE NUMERO 6 a06a = CLASSE 6 / 13

LIBELLE DE LA FORME GRAPHIQUE	---POURCENTAGE--- INTERNE	GLOBAL	INTERNE
1 BASES	14.29	.53	4.
2 DATOS	14.29	.80	4.
3 BASES_DATOS	10.71	.40	3.
4 MULTIMEDIA	10.71	.53	3.
5 CACienciasCompu	14.29	4.38	4.
6 MODELO	3.57	.53	1.
7 INFORMATICA	3.57	.53	1.
8 CienAplicadas	14.29	9.96	4.
2 Fisica	.00	3.19	0.
1 CExactasTecnologia	14.29	18.59	4.

Figura 12. Descripción interna de una clase de campo de investigación

TEXTE NUMERO 6 a06a = CLASSE 6 / 13

CRITERE DE CLASSIFICATION	REPONSE OU INDIVIDU CARACTERISTIQUE
2.168 --	1 CExactasTecnologia CienAplicadas
--	BASES_DATOS MULTIMEDIA
--	ANIMACION, BASES, DATOS, MEMORIA, MULTIMEDIA,
2.078 --	2 CExactasTecnologia CienAplicadas
--	BASES_DATOS
--	BASES, DATOS, PROTOTIPO, .
1.302 --	3 CExactasTecnologia CienAplicadas
--	BASES_DATOS
--	DEDUCTIVOS, DEPENDENCIA, MULTIVARIADA, AXIOMAS
--	INFERENCIA, BASES, DATOS, MODELO, .
1.273 --	4 CExactasTecnologia CienAplicadas
--	INFORMATICA

Figura 13. Algunas respuestas características de una clase de investigación

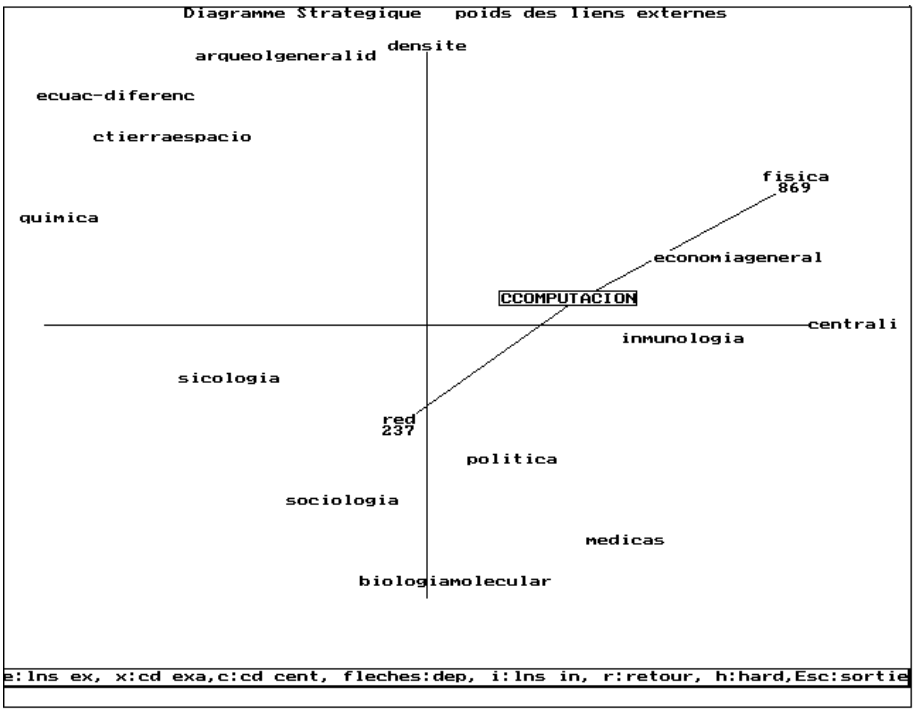


Figura 14. Ejemplo del método de palabras asociadas para el tema de investigación

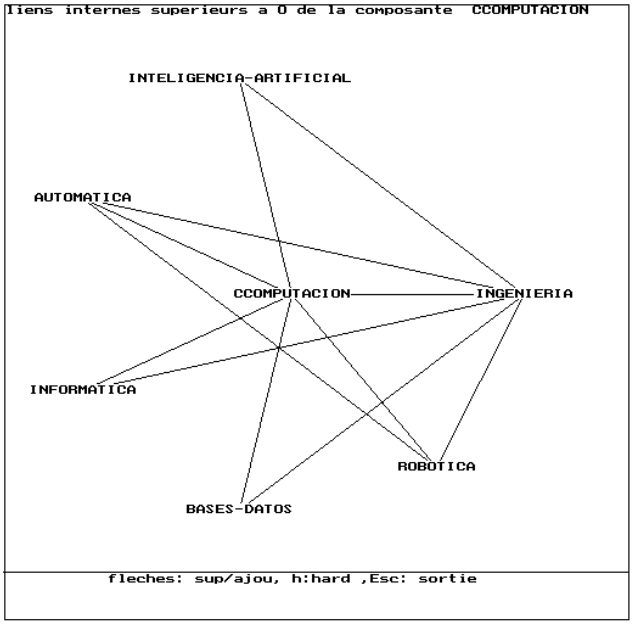


Figura 15. Ejemplo del método de palabras asociadas para el tema de investigación

Análisis Interno de las clases

Descubrir la composición de la población por temas no es suficiente para el investigador. El siguiente paso es hacer la descripción interna de cada clase. Desde el análisis de clases ya se han descubierto posiblemente algunos rasgos distintivos de cada uno, pero solo un análisis descriptivo interno puede revelar la características de cada grupo. El gráfico de la figura 16 por ejemplo muestra como puede estudiarse dentro de un clase de migración como es el movi-

miento interno, es decir como se tipifican internamente los individuos pertenecientes a cada clase. Otros análisis descriptivos revelaran por ejemplo como en donde están ubicados, que hacen, cual es su pensamiento de retorno al país etc., de por ejemplo los investigadores

El análisis final

El propósito final es hacer una descripción macro de la población. La propuesta es crear una variable por cada tema investigado, en donde cada categoría es una clase. Como cada clase ha sido ampliamente estudiado, es claro lo que significa pertenecer a uno cualquiera de ellos. Lo que nos proponemos es dar una descripción en términos de estas clases. Una análisis de correspondencia múltiple se aplicará, y su interpretará posiblemente la estructura general de la población estudiada.

Conclusión

Una de los grandes vacíos que este grupo de investigación ha encontrado en la revisión de trabajos en el área de las migraciones científicos es la no utilización de las técnicas modernas de análisis estadístico, fundamentalmente provenientes de la escuela francesa. Quizá la ausencia de una bibliografía adecuada que sin abandonar un tratamiento matemático mínimo trate de las aplicaciones concretas en el estudio de las ciencias sociales sea una de las principales causas. El proyecto de estudio “El brain gain revisited a través de caso colombiano. Estudio de la red Caldas”, del cual hace parte la encuesta “Redes Colombia” ha contado con un equipo multidisciplinario incluidos estadísticos que ha permitido avanzar de manera significativa en la utilización de tales herramientas en éste tipo de estudios, llegando incluso a presentar propuestas metodológicas. El propósito de estas notas ha sido presentar un avance de la metodología que con éxito ha sido aplicada en el proyecto.

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[1] Este proyecto de investigación es desarrollado por convenio entre las instituciones Universidad Nacional de Colombia la Universidad del Valle, y el Institut Français de Recherche pour le Developpement en Coopération con el apoyo de Colciencias e Icfes.

[2] La red Caldas fue establecida por Colciencias con el propósito de ser la red colombiana de investigadores y profesionales en el exterior. El objetivo de Colciencias al crear la fue incentivar la cooperación activa de la comunidad científica y profesional colombiana radicada en el exterior en el trabajo especializado de los grupos de investigación nacionales, abriendo la posibilidad de que se vincularan a proyectos de investigación en ejecución o promoviendo su participación en otros nuevos, así como al proceso de reestructuración del país que inició el presidente Gaviria. La red hace parte de las estrategias especiales formuladas dentro del plan nacional de ciencia y tecnología formulado en el gobierno Gaviria, dentro del ítem "fomento a grupos y redes", conducente a la formación de una comunidad Científica.

Synthesis and Conclusions

The Satellite: Towards a Local and Global Observation of the Circulation of Competence

Synthesis session of the symposium

Jean-Baptiste Meyer

We have just launched, during this symposium, a satellite of observation. Let us call it from the name of the art exhibition that accompanies it, “Spores”, which symbolizes the fruitful dissemination after an accumulation of three days and at the time of separation.

Why a satellite?

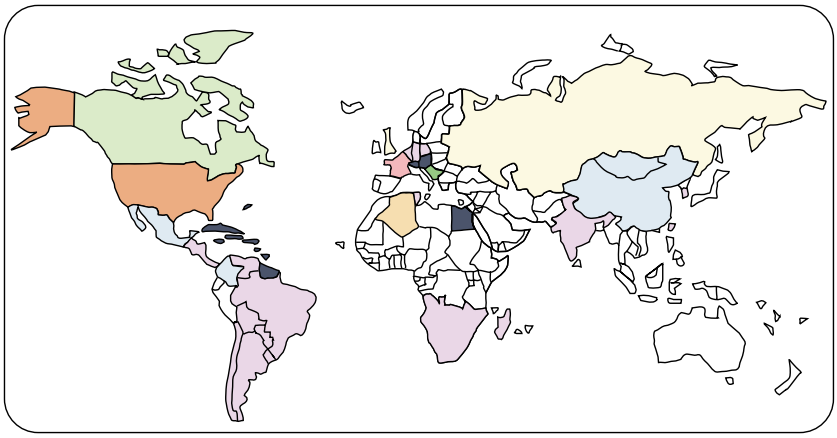
The metaphor of the satellite allows to display three dimensions of the symposium : the concentration of local images, the perspective given by the superposition of different angles of observation and a theoretical gravitation, about the issue of the international circulation of skills :

Concentration of local images

The symposium allowed the concentration of multiple local images, empirically constructed.

Overlapped, they offer a sustained and relatively complete restitution of the planetary flows (see following map : Geographic areas covered during the symposium). Obviously, we are still far from an exhaustive and uniform statistical measurement of the intellectual migratory flows ; it is an old dream that is still to be realized. But the presentation of problematics altogether different and comparable of the phenomenon, according to various regions of the world, may be a step in that direction.

The satellite has adopted a “ multifocus “. Indeed, the scale of observation varies greatly between the various communications, according to the emphasis that they put on micro or macroscopical analyses. Thus, we have passed from the regional (especially on Latin America) to the national (dozens of countries on all the continents), to the institution (National University of Mexico, Argentinian National Centre of Research), to the research group (laboratories in Argentina), to the social and scientific networks (Israël, Colombia), to research projects (Colombian diaspora) and to the own emigrated research individuals (Colombia, Hong Kong, Mexico). This variability of the scale of analysis makes combined visions possible from the general to the particular, as well as global approaches sustained by in depth analyses of detailed situations. We try this exercise in the following section.



Areas covered in the symposium.

Diversity of approaching angles

The images were taken with filters where different angles, which make the spectrum of particular phenomena vary according to the point of view adopted. There are three types of spectra : those concerning the different categories of intellectual migrant populations, those associated with the variable duration of the migration and those refering to the historical sequences of the phenomenon

Spectra of population

- Scientific researchers in all kinds of disciplines and working in the private or public sectors (majority of the communications)
- highly qualified personnel (lawyers, businessmen) in general on the problems of the transformation of the Hong Kong statute
- Asian and Latin American students, particularly from China, Korea and Chile
- engineers, technicians and professionals as in the migratory flows that characterize the new South Africa
- intellectuals in general or even artists in the group of Colombian expatriates.

The symposium dealt with the circulation of competence with respect to the creation of evidently scientific values, but also economic, technical and even aesthetic ones. In this, it went beyond the initial framework as defined by its title " International scientific migrations today ". This is significant and points out something : science could not be separated from other social activities, and probably less than ever before. The traditional circulation of scientists is going through transformations (cf. Oteiza, this volume) and spreads to various categories of skilled people. The magnitude that this trend has taken is a contemporary fact associated with the emergency of new international relations based on mobility and globalisation of factors (cf. Cardoza, Villegas ; Vessuri, this volume). However, this does not mean that professional identities are disolved in this generalised movement, as proved by the constitutive tension within the nodes of the Colombian diaspora between scientists and non-scientists (cf. Schlemmer et alii, this volume).

The aspects related to the length of migration

Permanent or long lasting migration, which continues to be the reference in a large number of contributions but which is increasingly replaced in empirical analysis by :
- the temporary migration or the return, even after an extended time, becomes a normal activity, such as in the case of Uruguay, Hong Kong, Argentina, Taiwan;

- mobility, notion according which both the departure and the return are not final and which characterizes a situation of elastic traveling, which are at the same time constructive sequences in the experience of a researcher, for example between France and the United States and for the stay to work, under a contract, in laboratories abroad by the Russians.

The migration of intellectuals adopts transitory forms similar to those noticed about other categories of population in different studies (Domenach and Picouet 1995 ; Simon 1995). To this respect, the symposium pinpoints the role by the highly qualified professionals in the revival of a nomadism which, according to demography experts, could substitute the form of sedentary organization which has been dominant for millenniums.

Historic spectrum

It extends over more than 80 years, from the beginning of the ‘20s to the approximation of the year 2000, with a strong concentration of contributions in recent times, that is, current events. What these different historical series reveal, are the articulations between the migratory phenomenon and the economic and sociopolitical regimes (in the sense of a form of collective organization).

Intellectual migratory phenomenon in the case of the fruitful expatriation of German humanists under the Nazism or of their homologous of hard sciences in the same country, in the Soviet Union and in the fascist Italy (Rabkin). Similar inquiries and different answers appear in the case of the democratic transitions that succeeded the recent Latin American dictatorships (Barreiro and Velho ; Kreimer ; Pellegrino and Cabella) or in the tensions between the State of the People’s Republic of China, the students of its universities or the reincorporating of Hong Kong or of Taiwan (Robbins and Tang, Pedersen and Lee ; Zhong).

Here there is a complete and intensive play between collective identity, mobility of people and selection of society. The symposium shows that the scientists are as active today as they were yesterday, though in a different manner. This permanence of an investment of intellectuals in political projects strongly contradicts the pseudo- “ désenchantement “ (disenchanting) of post-modernity.

Theoretical gravitation

Several contributions have constructed exercises of theoretical gravitation around the scientific migration issue. There was the historical approach of the transformation of migratory patterns (Oteiza), a bibliometric approach which presented an quite complete status of this field of study (Gaillard and Gaillard). There was also the approaches that offered a theoretical basis to the conception of the programs and of the policies of migration of qualified personnel for inter-governmental organizations (Cardoza and Villegas ; Marmora).

During this symposium the theoretical perspective on scientific migrations was made apparent and capable of feeding not only the academic thought but also decision making, and of searching among existing or new theoretical constructions possible formulations of strategies for scientific development.

After having passed inspection to the variety of communications of this symposium, we have evidenced a huge diversity of subjects and very uneven contents. The image that the satellite restores us now is therefore quite multicolor.

Is there a certain convergence of these heterogeneous contributions from which to reconstruct a sense, a new problematic on which to support ourselves for our future work ?

Points of convergence

There are two very strong points of convergence between all communications. The first one has to do with methodology and the second one with the contents.

An empirical approach

Ninety percent of the communications refer to recent scientific studies ; that is, that the discourse is supported by a specific work which serves as reference to it. Even the remaining 10 % is not made up by speculative discourses but rather by studies of systematic and supported compilation or by exact historical research. This epistemological and methodological posture is very significant : the idea is not to make a general model work but rather to understand first what is going on locally and give an autonomous explanation that may be worth for other cases and, therefore, overflow the local framework but that does not have the pretension of reducing the other explanations to its own in a global geo-political scheme. It is an important fact because it allows us to think that we have, thanks to this symposium, exceeded the old quarrels between internationalists and nationalists, who placed their explanations in an exclusive manner under the model of the market or of the center and the periphery.

New contents

There is a common sensation that results from the presentation of all these field studies : an impression of novelty. This is due to the recent nature of most of them, but also to the conceptual evaluation and to the political proposals that result, something as if everything changed at the same time : the situations analyzed, the instruments of their understanding as well as the conditions of the respective action. Here we have some examples of each one of these interdependent novelties :

a- The situations analyzed ; changes in the migratory nucleus. Certain countries of the South are considered as centers of attraction (Korea, Taiwan, Hong Kong) while others of the North of the Western World become emigration places (Russia and South Africa). This evidently distinguishes geopolitics of the flows of scientific personnel of today from those of yesterday : the South-North orientation, considered as irreversible, is no longer an absolute reality.

b- The terminology around the concept of migration has been seriously demultiplied : during this symposium ; terms more or less new appeared and proliferated, when previously the concept of **Brain Drain** would have been the only one. It is a noticeable renewal of the problematic of the field of study. Naturally, there is the **Brain Grain**, the recovery through return programmes or else (Narvaez berthelemot and Rosas, Pifat and Cano, Pedersen and Lee, Song, Zhong), but also the term **mobility** which defines the circulatory and dynamic intrinsic apprehension of scientific activity (Charum, Murcia and Parrado, Vessuri), and of **diaspora** which capitalizes on the dispersion rather than be afflicted by it, that of the **transitional psychoanalytical objects** which permit the positive and creative identification of the expatriate intelligence to a community (Miramon), that of **center and periphery** which is no longer structural and unbeatable, but flexible and capable of being manipulated by the actor (Carlson and Martin Rovet), and there is also the term **astronaut** which refers to the recurrent weightlessness of the highly skilled professionals in an almost perpetual movement (Zhong). This is a conceptual poliphony that enriches in a singular manner the debate on the intellectual migratory phenomenon and provides frameworks of interpretation a lot less unequivocal than before.

The symposium also evidences an evolution of the attitudes, of the strategies and of the poli-

cies with respect to the migrations of scientists. There is less talk about macroscopic conditions which will determine in excess the scientific activity, such as the economic situation or the global policy and there is greater dedication to seek solutions in relation to the local labour market (Kitova, Kouznetsova), the installation of critical masses where this activity may germinate (Barreiro and Velho), weaving networks capable of attracting human or material resources, making denser the local scientific web or extending it to the world in order to encourage the return or demultiply the limited capacity (Toren, Krishna, Dezhina, Meyer and Granés).

The diaspora option

The detailed presentation and description of the diaspora option represents an extremely concrete contribution of the symposium and probably also a lasting subject for exchanges and cooperation among participants. The recorders have just told us up to what extent the configuration in groups of expatriates had become a presentiment as a promising form to extend the base and multiply the intellectual capacity of a single country or a region.

The significant fact is that in regions of the world so different as Croatia, Maghreb, Central America, Chile, Venezuela, Uruguay, China and Latin America as a group, there appear, simultaneously, without a previous agreement and in a spontaneous manner, the same strategic orientation of mobilization of competence located outside the country or the region.

This is pretty similar to these experimental discoveries, concomitant but independent, which are made at the same time in different places of the world by different groups that later dispute parenthood. Kuhn explains this very well through the existence of a same paradigm that orients the problematic, the heuristic methods and the research procedures beyond the conscience of the actors and makes them achieve the same result more or less at the same time.

Do we find ourselves then at the dawn of a new paradigm in the geopolitics of scientific migrations, capable of replacing the “brain drain” disqualified for being non-operative in the context of the contemporaneous global society ?

Two years ago in Paris, in a meeting such as this one, we had presented a theoretical refutation of the brain drain showing that it was based on the atomist principle established on economicist or mechanicist premises. In its economicist version, that of the internationalists, the brain is moved by the supply and demand law in an international market of skills that preside instantaneously in a transparent and fluid manner, their optimal assignment. In its mechanicist version, that of the nationalists, the supply and demand are replaced by the center and the periphery, the brain is subject to a pure and simple attraction force (Meyer and Charum 1994, 1995).

These two versions assume an individuality and an exchange of skills that we have already proven as purely fictitious : Competence has no value by itself but always associated to entities without which it can never be performed. Several schools reveal this without any ambiguity : the Mertonian school that emphasizes scientific creativity as a collective, institutional and never individual fact. The Kunhian school that reinforces the Mertonian community with a cognitive dimension : the brain can not think without being enrolled in a collectively constructed frame, the paradigm. The relativistic school reinforces even more the fact showing how the tacit knowledge results from an extended learning, what Harry Collins calls enculturation, indispensable for the experimental work. Finally the relationist school insists on the association of the brain with multiple social and technical devices, inside and outside the laboratory, in order that an effective action can be developed.

The brain does not move in an absolute emptiness between different polarities but within the networks that connect it to multiple entities through which it circulates and sometimes stays in a stable configuration. This is not a trivial or speculative consideration. It determines basically the strategies of brain gain for several years back.

The brain gain is developed according to two options : the return option and the diaspora option. The first one requires the local reconstitution of a dense network of relations and resources, a receptive web, in order that the activity of the repatriate researcher may germinate.

The success of Korea in this field is quite significant. We have seen that the success of its Brain Gain strategy is tied to the creation and development of a consistent infrastructure of Research and Development and Science and Technology. We could therefore call this version of the grain gain : structural version, since it founds the structure, by political decision, to insert the talent (Song).

The second option, the grouping of expatriates abroad, would be a reticular version (of network) since it attempts to mobilize and establish ties between pre-existing entities of which it reorganizes the associations for its project, this also defined by a political decision.

This option is particularly fruitful since it saves expensive preconditions as refers to the resources and the investments, in order to achieve it. The knowledge, the equipment, the infrastructure are already present at the side of the people, of the actors of the network.

Without wanting to institute this option of groups of expatriates abroad as a model, we had proposed to define a modus operandis, two years ago, testing the Colombian case of the Caldas network (Gaillard and Meyer 1995).

That is what we did and it is a small part of the results of this study that was presented in this symposium. These results prove that the option of the groups of Colombian expatriates is no longer a hypothesis but a reality. We now know why and how it operates -rather well- and we can indicate the road to follow for the best development.

In particular, the indicators that were presented and explained are very powerful decision instruments. In fact, the main problem of this option of groups of expatriates abroad is its intrinsic dispersion which harms aggregation, the installation of critical qualitative masses that may permit the development of multi-place research activities (Charum, Montenegro).

On the other hand, we have evidenced, for example, that the subject clusters defined as of the Colombian survey, permit to identify precisely the location of compatible and convergent competences, in the heterogeneous and disperse world of the groups of expatriates abroad. These methods act somewhat as sensors : they immediately locate the possible neighborhoods in a multitude of particular descriptors and operate the virtually fecund aggregations. The groups of Colombian expatriates is presented then under the form of a hypertext in which an observer navigates to search for the interlocutors that interest him for a particular project. This observer may be a minister of research, the director of an institution, or an individual researcher. Imagine this tool available to a policy to select its priorities as a function of the best availabilities and of the objectives established by its society !

One of the massive results of the symposium is to have started to exchange not only problems and information, but also, already, useful answers for one and the other. The Colombian case permits today, to the other cases of the diaspora option mentioned during the symposium, to support on a concrete experience that requires perfecting, naturally, but that as of now can be reproduced. Naturally, it does not refer to routine tools : a permanent research work is required. This is just the vocation of the satellite : to share this research work no longer in a sporadic manner but in a continued manner. We have committed to a work of important challenges since this refers to the worldwide circulation of knowledge and competences. There is still a lot to be done as far as going deeper into the situations and the concepts and developing the methods of the proposal. But we have initiated the work, we have launched the satellite. Now it is our common task to keep it in orbit.

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El satélite : hacia la observación local y global de la circulación de las competencias

Sesión de síntesis del simposio

Jean-Baptiste Meyer

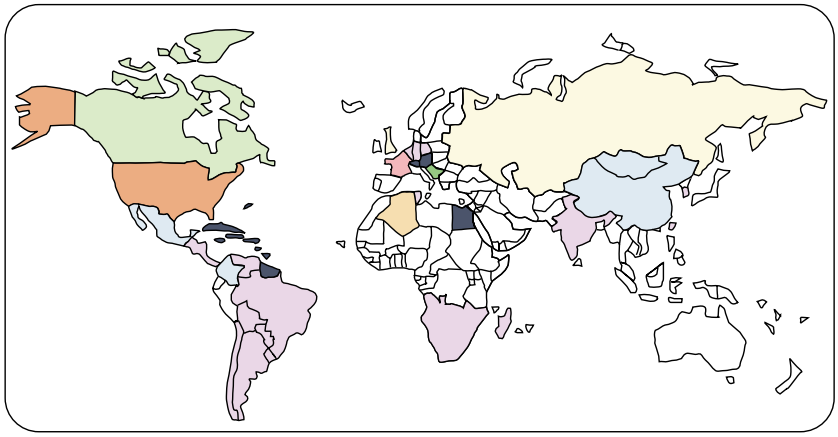
Durante este Simposio, hemos lanzado un satélite de observación. Se llama “Esporas”, al igual que el nombre de la exposición artística que lo acompaña y que simboliza la diseminación fructífera luego de una acumulación de tres días y en el momento de la separación.

¿Por qué un satélite?

La metafora del satélite permite restituir tres dimensiones del simposio : la concentracion de imagenes locales, la puesta en perspectiva de angulos de vision distintos y una gravitación teorica, a proposito de las migraciones intelectuales.

La concentración de imágenes locales

EL encuentro ha permitido la concentración de una multitud de imágenes locales, empíricamente construidas. Yuxtapuestas, ellas nos ofrecen una restitución sostenida y relativamente completa de los flujos planetarios (cf el siguiente mapa : áreas geográficas cubiertas durante el Simposio). Por supuesto, estamos todavia lejos de una medición exhaustiva y uniforme de los flujos migratorios intelectuales ; es un antiguo sueno que queda por realizar (UNCTAD 1984). Pero la presentación de problematicas a la vez distintas y comparables del fenomeno, segun sus manifestaciones en diversas regiones del mundo, puede constituir un paso hacia su realización. El satélite adopto un lente multifocal. La escala de observación de las diversas ponencias variaba ampliamente según privilegiaban los aspectos micro o macroscopicos. Hemos así pasado de lo regional (sobre America Latina esencialmente) a lo nacional (decenas de paises en todos los continentes), a la institución (Universidad nacional Autonoma de mexico, Centro nacional de Investigación Cientifica de Argentian), al grupo de investigación (laboratorios argentinos), a las redes sociales y cientificas (Israël, Colombia), a los proyectos de investigación (Argentina, diaspora colombiana) y a los mismos individuos investigadores emigrados (Hong Kong, Colombia, Mexico). Esta variabilidad de la escala permite visiones combinadas, del general al particular y analisis globales apoyados sobre la espesura de situaciones detalladas. Intentamos este ejercicio mas adelante.



Las regiones investigadas por el simposio

Diversidad de los ángulos de visión

Las imágenes han sido tomadas con filtros y con ángulos diferentes, haciendo variar el espectro de los fenómenos particulares según el punto de vista adoptado. Hay tres tipos de espectros : los que tienen que ver con las diferentes poblaciones intelectuales migrantes ; los asociado con la duración variable de la migración y los que refieren a las varias epocas historicas del fenomeno.

Los espectros de la población

- Investigadores científicos en todas las disciplinas y trabajando en los sectores privado o publico (la mayoria de las comunicaciones)
- personal altamente calificado en general (juristas, hombres de negocio), en la problemática de la transformación del status de Hong Kong,
- estudiantes asiáticos y latinoamericanos, particularmente de China, de Corea, de Chile,
- ingenieros, técnicos y profesionales como en los flujos migratorios que caracterizan a la nueve Africa del Sur,
- intelectuales en general o incluso artistas, en la diáspora colombiana.

Así, el Simposio ha tratado sobre la circulación de las competencias en su relación con la creación de valores ciertamente científicos pero también económicos, técnicos y aun estéticos. En ese sentido, fue mas alla del marco inicial como definido por su titulo « Migraciones cientificas interancionales ». Eso es significante y demuestra una tendencia : la ciencia, menos que nunca, se puede separar de otras actividades sociales. La tradicional circulación de los sabios se transforma (cf Oteiza, este volumen) y se extiende a otras categorias de detenidores de competencias. La magnitud que ha tomado este movimiento es un hecho contemporaneo ligado a la emergencia de nuevas relaciones internacionales basadas sobre la movilidad y la globalización especialmente de los factores (Cardoza y Villegas, Vessuri). Por lo tanto, las identificaciones socio-profesionales no estan obligatoriamente disluidas por este movimiento generalizado, como lo muestra la tensión constitutiva en los nodos de la diaspora colombiana entre cientificos y no-cientificos.

Los espectros relativos a la duración de la migración

- Migración permanente o durable, que continua siendo la referencia en un gran número de contribuciones pero que se desplaza cada vez más en los análisis empíricos hacia,
- la migración temporal, en la que el retorno, incluso luego de un tiempo prolongado llega a ser

una actitud normal, como en el caso del Uruguay, de Hong Kong, de la Argentina de Taiwan,
- la movilidad, noción en la que la partida y el regreso no son definitivos y que caracteriza una situación de desplazamientos elásticos, que son otras tantas secuencias constructivas en la trayectoria de un investigador, por ejemplo entre Francia y Estados Unidos y en las estadías de trabajo de los Rusos bajo contrato en los laboratorios en el exterior.

La migración de los intelectuales adopta un caracter transitorio, al igual que para otras categorias de población como lo anotaron otros estudios (Domenach y Picouet 1995, Simon 1995). En este sentido el Simposio poner en evidencia el papel de las profesiones altamente calificadas en la renovación de un nomadismo que, según los demógrafos, podría sustituirse a la forma de organización sedentaria dominante por milenios.

El espectro histórico

Se extiende por cerca de 80 años, entre los comienzos de los años 20 y las cercanías del año 2000 con una fuerte concentración en épocas muy recientes, incluso actuales. Lo que revelan estas diferentes series históricas son las articulaciones entre el fenómeno migratorio y los regímenes (en el sentido de organización colectiva) económicos y sociopolíticos. Fenómeno migratorio intelectual en el caso de la fecunda expatriación de los humanistas alemanes bajo el nazismo o de sus homólogos de las ciencias duras del mismo país, de la Unión Soviética o de la Italia fascista (Rabkin). Similares interrogaciones y respuestas diferentes aparecen en los casos de transición democrática que suceden a las dictaduras latinoamericanas recientes (Barreiro y Velho ; Kreimer ; Pellegrino y Cabella) o en las tensiones entre el Estado de China popular, los estudiantes de sus universidades o en la reincorporación de Hong Kong o de Taiwan (Robins y Tang ; Pedersen y Lee ; Zhong).

Se encuentra aquí un complejo e intenso juego entre identidad colectiva, movilidad de las personas y opciones de sociedad. El Simposio muestra cómo en esto los científicos son con frecuencia activos, tanto hoy como ayer, aunque de modo diferente. Esta persistencia de un compromiso de los intelectuales en los proyectos políticos es un fuerte desmentido al pseudo-desencanto de la postmodernidad.

Gravitación teórica

Varias de las contribuciones se han constituido en ejercicios de gravitación teórica alrededor del tema migratorio científico. Se tiene el acercamiento historico a la transformación de los patrones migratorios (Oteiza), acercamiento bibliométrico que presenta un estado muy completo de este dominio de estudio. Se tiene igualmente perspectivas que ofrecen una base teórica a la concepción de los programas y las políticas de migración de personal calificado para los organismos intergubernamentales (Cardoza y Villegas, Marmora).

Lo que entonces ha aparecido durante este Simposio es una puesta en perspectiva teórica de las migraciones científicas, susceptible de alimentar no sólo la reflexión académica sino también la toma de posición., de buscar en las construcciones teóricas nuevas o ya existentes formulaciones posibles de estrategias de desarrollo científico.

Después de haber revisado la multiplicidad de las contribuciones de este Simposio constatamos la gran diversidad temática con una gran disparidad en los contenidos. La imagen que nos restituye el satélite es, entonces, multicolor.

¿Hay en estos aportes heterogéneos convergencias a partir de los cuales un sentido, una nueva problemática sobre la cual apoyarse para nuestros futuros trabajos?

Puntos de convergencia

Hay dos fuertes puntos de convergencia entre todas las comunicaciones. El primero se refiere sobre la perspectiva y el segundo sobre el contenido

Una perspectiva empírica

90 % de las ponencias se basan en estudios empíricos recientes, es decir, el discurso está armado con base en el trabajo específico que le sirve de referente. Además, el 10 % restante no está constituido por discursos especulativos sino más bien por trabajos de compilación sistemática y argumentada o de investigaciones históricas precisas. Esta postura epistemológica y metodológica es muy significativa : no se tiende a hacer funcionar un modelo general, más bien tienden a inicialmente a comprender lo que pasa localmente y a dar a partir de esto una explicación autónoma que puede valer para otros casos pero que no tiene la pretensión de reducir las otras explicaciones a la suya propia, dentro de un esquema geopolítico global. Es un hecho importante porque nos permite pensar que hemos, en este Simposio, superado las viejas querellas entre internacionalistas y nacionalistas, que ubicaban sus explicaciones de manera exclusiva bajo el modelo del mercado o del centro y la periferia.

Nuevos contenidos

Queda una sensación común que brota luego de la presentación de todos estos estudios de terreno : la impresión de novedad. Esta se debe al carácter reciente de la mayor parte de ellas tanto como a la evaluación conceptual y a las proposiciones políticas que se han hecho, un poco como si todo cambiara en el tiempo : las situaciones analizadas, los instrumentos de su comprensión así como las condiciones de la acción que de ellos se derivan. Veamos algunos ejemplos de cada una de estas tres novedades interdependientes :

a- Las situaciones analizadas : cambios en las fuentes migratorias. Algunos países del Sur son considerados como centros de atracción (Corea del Sur, Taiwan, Hong Kong) en tanto que otros del Norte o del mundo occidental devienen lugares de emigración (Rusia y Africa del Sur). Esto evidentemente introduce una distinción entre la geopolítica de los flujos de personal científico de hoy y los de ayer : la orientación Sur-Norte, considerada por mucho tiempo como irreversible, ya no es más una realidad absoluta.

b- La terminología alrededor del mismo concepto de migración se ha seriamente multiplicado : durante este Simposio han aparecido y han proliferado términos más o menos nuevos, allí donde antes sólo el concepto de Brain Drain hubiera prevalecido. Se trata entonces de una notable renovación del campo de estudio. Ciertamente hay el *Brain Gain*, la recuperación a través de programas de retorno o otros (Narvaez Berthelemot y Rosas, Pifat Y Cano, Pedersen y Lee, Song, Zhong), pero también el término *movilidad* que define una aprehensión intrínsecamente circulatoria y dinámica de la actividad científica (Charum, Murcia y Parrado, Vessuri), el de *diáspora* que capitaliza sobre la dispersión en lugar de lamentarse de ella (Belgacem, de la Vega, Montenegro, etc...), el de *objetos psicoanalíticos transaccionales* que permiten la identificación positiva y creadora de la inteligencia expatriada de una comunidad (Miramon), el de *centro y periferia* que ya no es más estructural e insuperable sino coyuntural y manipulable por el actor (Martin Rovet y Carlson) y también se encuentra el término de *astronauta* que se refiere a la ingravidez recurrente de los poseedores de competencias en movimiento casi perpetuo (Zhong). Se tiene entonces una polifonía conceptual que enriquece singularmente el

debate sobre el fenómeno migratorio intelectual y provee marcos de interpretación mucho más unívocas que antes.

c- El Simposio da igualmente testimonio de una evolución de las actitudes, de las estrategias y de las políticas frente a las migraciones de científicos. Se habla menos de condiciones macroscópicas que sobredeterminarían imperiosamente la actividad científica, tales como la situación económica o política global y se opta más por la búsqueda de soluciones en relación con el mercado local del trabajo (Kitova, Kouznetsova), la instalación de masas críticas donde puede enracinar esta actividad (Barreiro y Velho), tejiendo redes susceptibles de captar los recursos humanos o materiales, densificando el tejido científico local o extendiéndolo al mundo para estimular el retorno o multiplicar la capacidad limitada (Toren, Dezhina, Krishna, Meyer y granés).

La opción diáspora

La presentación y la descripción detallada de la opción diáspora constituye un aporte extremamente concreto del Simposio y representa indudablemente un tema durable de intercambios y de cooperación entre los participantes.

Los relatores nos han revelado hasta qué punto la configuración en diáspora de la comunidad científica se presentía como una forma prometedora para ampliar la base y multiplicar la capacidad intelectual de un país.

El hecho significativo está en que en regiones del mundo tan diferentes como Croacia, el Maghreb, la América Central, Chile, Venezuela, Uruguay, China, la región de América Latina en su conjunto, aparecen en el mismo momento, sin concertación y de manera espontánea, la misma orientación estratégica de movilización de las competencias situadas en el exterior del país o de la región.

Esto se asemeja a esos descubrimientos experimentales, concomitantes pero independientes que realizan al mismo tiempo en diferentes puntos del globo equipos distintos que a continuación se disputan su paternidad. Kuhn explica esto muy bien por la existencia de un mismo paradigma que orienta las problemáticas, los métodos heurísticos y los procedimientos de investigación más allá de la conciencia de los actores y que les permite alcanzar el mismo resultado casi al mismo tiempo....

¿Estamos entonces en el alba de un nuevo paradigma en la geopolítica de las migraciones científicas y susceptible de remplazar el de “brain drain” descalificado por su inoperancia en el contexto de la sociedad global contemporánea ?

Hace dos años, en París en un encuentro como éste, habíamos presentado una refutación teórica del brain drain demostrando que estaba basado en un principio atomista establecido sobre premisas economicistas y mecanicistas. En su versión economicista, la de los internacionalistas, el cerebro estaba movido por la ley de la oferta y la demanda, en un mercado internacional de las competencias que preside instantáneamente, de manera transparente y fluida, su óptima ubicación. En su versión mecanicista, la de los nacionalistas, la demanda y la oferta están remplazada por el centro y la periferia y el cerebro se encuentra sometido a una fuerza de atracción pura y simple (Meyer Charum 1994, 1995).

Estas dos versiones suponen una individualidad y una intercambiabilidad de las competencias de las que habíamos probado que eran pura y simplemente ficticias : la competencia no tiene valor cuando se encuentra aislada sino que debe estar siempre asociada a entidades sin las cuales ella nunca puede actualizarse. Múltiples escuelas lo revelan sin ambigüedad : la escuela

mertoniana que subraya la actividad científica como un hecho colectivo, institucional y nunca individual. La escuela kuhniana que refuerza la comunidad mertoniana con una dimensión cognitiva : el cerebro no puede pensar sin estar inscrito en un marco colectivamente construido, el paradigma. La escuela relativista rrefuerza este punto mostrando como los saberes tácitos resultantes del aprendizaje prolongado, lo que Harry Collins llama enculturación, son indispensables en el trabajo experimental. Finalmente, la escuela relacionista insiste sobre la asociación del cerebro con múltiples dispositivos sociales y técnicos, en el interior y en el exterior del laboratorio, para que pueda desarrollar una acción efectiva.

El cerebro no se desplaza en un vacío absoluto entre polaridades diferentes sino que lo hace en el interior de redes que lo vinculan a múltiples entidades por las que circula y en ocasiones se instala en una configuración estable. No es esta una consideración trivial o especulativa. Ella determina fundamentalmente las estrategias de brain gain desde hace años.

El brain gain se desarrolla según dos opciones : la opción retorno y la opción diáspora. La primera supone que se reconstituya localmente una malla densa de relaciones y de recursos, un tejido receptivo para que la actividad del investigador repatriado pueda arraigar. Los logros de Corea en este dominio son muy significativos. Hemos visto que el de su estrategia de brain gain está ligado a la creación y al desarrollo de una infraestructura de Ciencia y Tecnología, de Investigación y Desarrollo consistentes (Song). Podríamos entonces llamar a esta versión del brain gain, la versión estructural puesto que pone las bases de la estructura, por decisión política, para insertar al talento.

La segunda opción, la opción diáspora, sería una versión reticular (de red) puesto que busca movilizar e instaurar vínculos entre las entidades preexistentes de las que reorganiza las asociaciones para su proyecto, proyecto también definido por una decisión política. Esta opción es particularmente fecunda porque dispensa, para su realización, de las pesadas precondiciones en lo que concierne a los recursos y a las inversiones. Los conocimientos, los equipos, las infraestructuras están ya al lado de las personas, de los actores de la red.

Sin pretender erigir esta opción en modelo habíamos propuesto definir un *modus operandi*, hace dos años, probándola para el caso colombiano de la red Caldas (Gaillard y Meyer 1995). Es lo que hemos hecho y es una pequeña pare de este trabajo lo que ha sido presentado en este Simposio. Estos resultados prueban que la opción diáspora ya no es sólo una hipótesis sino una realidad. Ahora sabemos por qué y cómo ella funciona -más o menos bien- y podemos indicar el camino a seguir para desarrollarla en la mejor forma.

En particular, los indicadores que han sido presentados y explicados son poderosos instrumentos de decisión. En efecto, el mayor problema de la opción diáspora es su dispersión intrínseca que dificulta la agregación, la instalación de masas cualitativas críticas que puedan permitir el desarrollo de actividades de investigación multilocales (Charum, Montenegro).

Pero hemos constatado, por ejemplo, que los clusters temáticos definidos a partir de la encuesta colombiana permiten identificar rigurosamente la localización de competencias compatibles y convergentes, en el mundo heterogéneo y disperso de la diáspora. Estos métodos obran entonces un poco como sensores : ubican las vecindades posibles en una multitud de descriptores particulares y operan las agregaciones virtualmente fecundas.... La diáspora se presenta entonces bajo la forma de un hipertexto en el que un observador navega para buscar cuales interlocutores le interesan para un proyecto particular. Este observador puede ser un ministro de la investigación, un responsable de una institución, un investigador individual. ¡Imagínense una herramienta de este tipo a disposición de una política para seleccionar sus prioridades en función de mejores disponibilidades y objetivos que se fija la sociedad que ella conduce !

Uno de los resultados importantes de este Simposio es haber comenzado a intercambiar no sólo preguntas e informaciones sino también, ya, respuestas útiles a unas y otras. El caso colombiano permite hoy, a los otros casos de la opción diáspora evocados durante este Simposio,

apoyarse sobre una experiencia concreta, ciertamente perfectible pero desde ya reproducible. Por supuesto no se trata de herramientas rutinizadas, requieren de un trabajo permanente de investigación. Esta es precisamente la vocación del satélite : compartir este trabajo de investigación no de manera esporádica sino continua. Estamos aquí comprometidos con una obra de profundas implicaciones puesto que se trata de la circulación mundial de los conocimientos y de las competencias. Hay un enorme número de situaciones por profundizar, de conceptos por desarrollar y de métodos por proponer. Hemos comenzado aquí este trabajo. Hemos lanzado el satélite, será ahora necesario mantenerlo en órbita.

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Le satellite : vers une observation locale et globale de la circulation des compétences

Séance de synthèse du symposium

Jean-Baptiste Meyer

Nous venons de lancer, pendant ce symposium, un satellite d'observation.

Appelons-le du nom de l'exposition artistique qui l'accompagne, « Spores », symbolisant la dissémination fructifère après une accumulation de 3 jours et à l'heure de la séparation.

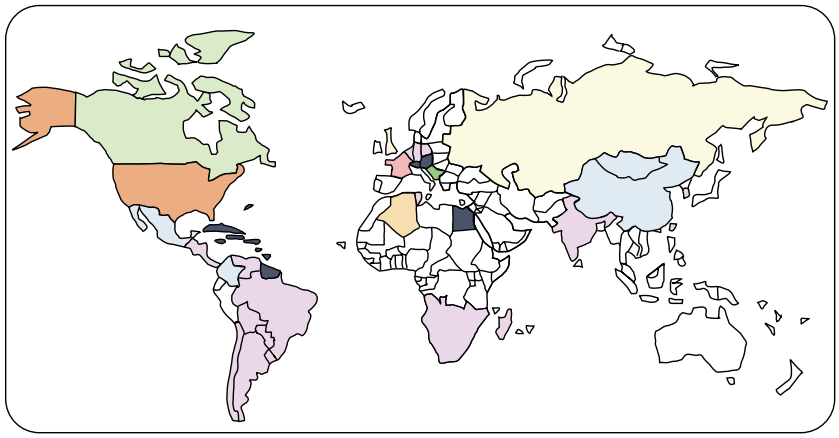
Pourquoi un satellite ?

La métaphore du satellite permet de restituer trois dimensions du symposium : la concentration d'images locales, la mise en perspective d'angles d'approche différents et une gravitation théorique, à propos du phénomène de la migration internationale des compétences.

La concentration d'images locales

Le symposium a permis la concentration d'une multitude d'images locales, empiriquement construites. Juxtaposées, elle offrent une restitution soutenue et relativement complète des flux planétaires (cf. carte). Certes, nous sommes encore loin d'une mesure statistique exhaustive et uniforme de ces flux migratoires intellectuels ; c'est un rêve ancien qui reste à accomplir (cf. UNCTAD 1984). Mais la présentation des problèmatiques à la fois différentes et comparables du phénomène, selon ses manifestations dans diverses régions du monde, peut constituer un pas dans sa réalisation.

Le satellite a adopté une « lunette » multifocale. L'échelle d'observation varie grandement, en effet, entre les diverses communications, selon qu'elles privilégient l'analyse micro- ou macroscopique. Nous sommes ainsi passés du régional (sur l'Amérique latine essentiellement), au national (plusieurs dizaines de pays sur tous les continents), à l'institution (Université nationale autonome de Mexico, Centre national de recherche scientifique argentin), au groupe de recherche (laboratoires argentins), aux réseaux sociaux et scientifiques (Israël, Colombie), aux projets de recherche (Argentine, diaspora colombienne) et aux individus chercheurs émigrés eux-mêmes (Colombie, Hong Kong, Mexique). Cette variabilité de l'échelle rend possible des visions combinées du général au particulier et des analyses globales s'étayant sur l'épaisseur de situations détaillées. Nous nous essayons à cet exercice ci-après.



Zones géographiques couvertes par le symposium

Diversité des angles d'approche

Les images ont été prises avec des filtres ou des angles différents, faisant varier le spectre des phénomènes particuliers selon le point de vue adopté. Il y a 3 types de spectres : ceux concernant les différentes catégories de populations intellectuelles migrantes ; ceux relatifs aux durées variables de la migration ; ceux qui se réfèrent aux époques historiques du phénomène.

Les spectres de la population

- Chercheurs scientifiques, dans toutes les disciplines et œuvrant dans les secteurs privé ou public (majorité des communications) ;
- personnel hautement qualifié (juristes, hommes d'affaires, etc.) en général dans la problématique de la transformation du statut de Hong Kong ;
- étudiants asiatiques et latino-américains, particulièrement de Chine, de Corée, du Chili ;
- ingénieurs, techniciens et professionnels comme dans les flux migratoires caractérisant la nouvelle Afrique du Sud ;
- intellectuels en général (hommes de lettre) ou même artistes, dans la diaspora colombienne.

Le symposium a donc traité de la circulation des compétences en rapport avec la création de valeurs scientifiques certes mais aussi économiques, techniques et esthétiques. En ce sens, il a débordé du cadre initial marqué par son intitulé « Migrations scientifiques internationales ». Cela n'est guère anodin et dénote une tendance : la science est moins que jamais isolable des autres activités sociales. La traditionnelle circulation des savants se transforme (cf. Oteiza, cet ouvrage) et s'étend à celle de multiples catégories de détenteurs de compétences. L'ampleur qu'a pris ce mouvement est un fait contemporain lié à l'émergence de nouvelles relations internationales fondées sur la mobilité et la globalisation notamment des facteurs (cf. Vessuri, Cardoza et Villegas, cet ouvrage). Pour autant, les identifications socio-professionnelles ne sont pas forcément mixées dans ce mouvement généralisé, comme le prouve la tension constitutive des noeuds de la diaspora colombienne entre « scientifiques et non-scientifiques » (cf. Schlemmer et al., cet ouvrage).

Les spectres relatifs à la durée de la migration

- migration permanente ou durable, qui reste la référence dans un grand nombre de contributions mais qui se trouve de plus en plus déplacée dans les analyses empiriques par :
- la migration temporaire, où le retour, même après un temps prolongé devient une attitude normale, comme dans le cas de l'Uruguay, de Hong Kong, de l'Argentine, de Taiwan ;

- la mobilité, notion dans laquelle le départ comme le retour ne sont pas définitifs et qui caractérise une situation de déplacements élastiques, qui sont autant de séquences constructives dans la trajectoire d'un chercheur, par exemple entre la France et les États-Unis ou pour les séjours de travail des Russes sous contrat dans des laboratoires à l'extérieur.

La migration des intellectuels adopte un caractère transitoire relevé par ailleurs dans des études sur d'autres catégories de population (Domenach et Picouet 1995, Simon 1995). En ce sens, le symposium met le doigt sur le rôle des professions qualifiées dans le renouveau d'un nomadisme qui, selon les démographes, pourrait se substituer à la forme d'organisation sédentaire dominante depuis des millénaires.

Le spectre historique

Il s'étend sur près de 80 ans, entre le début des années 20 et l'approche de l'an 2000 avec une forte concentration des contributions sur des époques très récentes, voire sur l'actualité. Ce que révèlent ces différentes séries historiques, ce sont les articulations entre le phénomène migratoire et les régimes (au sens de forme d'organisation collective) économiques et socio-politiques. Phénomène migratoire intellectuel dans le cas de l'expatriation féconde des humanistes allemands sous le nazisme ou de leurs homologues des sciences dures dans le même pays, en Union soviètique ou en Italie fasciste (Rabkin). Des interrogations similaires et des réponses différentes apparaissent dans les cas de transitions démocratiques succédant aux dictatures latino-américaines récentes (Barreiro et Velho ; Kreimer ; Pellegrino) ou dans les tensions entre l'État de Chine populaire, les étudiants de ses universités ou la réincorporation de Hong Kong ou de Taiwan (Robbins et Tang ; Pedersen et Lee ; Zhong).

Il y a là un jeu complexe et intense entre identité collective, mobilité des personnes et choix de société. Le symposium montre que les scientifiques y sont souvent actifs aujourd'hui tout autant qu'hier, même si de façon différente. Cette rémanence d'un investissement des intellectuels sur des projets politiques est un démenti cinglant au pseudo-désenchantement de la postmodernité.

Gravitation théorique

Plusieurs contributions constituent des exercices de gravitation théorique autour du thème migratoire scientifique. Il y a l'approche historique de la transformation des patrons migratoires (Oteiza), une approche bibliométrique dressant un état très complet de ce domaine d'étude (Gaillard, Gaillard). Il y a également les approches offrant une base théorique à la conception des programmes et des politiques de migration de personnel qualifié pour les organismes intergouvernementaux (Marmora ; Cardoza, Villegas).

Ce qui est donc apparu pendant ce symposium, c'est une mise en perspective théorique sur les migrations scientifiques, susceptible d'alimenter non seulement la réflexion académique mais aussi la prise de décision, de chercher dans les constructions théoriques existantes ou nouvelles des formulations possibles de stratégies de développement scientifique.

Après avoir ainsi passé en revue un éventail des communications de ce symposium nous constatons une grande diversité thématique, des contenus très disparates. L'image que nous restitue maintenant le satellite est donc très multicolore.

Y-a-t-il certaines convergences de ces apports hétérogènes à partir desquelles reconstruire un sens, une nouvelle problématique sur laquelle s'appuyer pour nos travaux futurs ?

Points de convergence

Il y a deux points de convergence très forts entre toutes les communications. Le premier porte sur la démarche et le second sur le contenu.

Une démarche empirique

90 % des communications portent sur des études empiriques récentes ; c'est-à-dire que le discours est armé par un travail spécifique qui lui sert de référent. Même les 10 % restant ne sont guère constitués par des discours spéculatifs mais plutôt par des travaux de compilation systématique et argumenté ou d'investigations historiques précises. Cette posture épistémologique et méthodologique est très significative : on ne cherche pas à faire fonctionner un modèle général mais bien plutôt à comprendre d'abord ce qui se passe localement et à en donner une explication autonome, qui peut valoir pour d'autres cas et déborde donc le cadre local mais qui n'a pas de prétention à réduire les autres explications à la sienne, dans un schéma géopolitique global. C'est un fait important parce qu'il nous permet de penser que nous avons, par ce symposium, surmonté les vieilles querelles entre internationalistes et nationalistes, qui plaçaient leurs explications de façon exclusive sous le modèle du marché ou du centre et la périphérie.

Des contenus nouveaux

Il y a une sensation commune qui ressort après la présentation de toutes ces études de terrain : une impression de nouveauté. Cela tient au caractère récent de la plupart d'entre elles mais aussi à l'évaluation conceptuelle et aux propositions politiques qui en sont faites, un petit peu comme si tout changeait en même temps : les situations analysées, les instruments de leur compréhension ainsi que les conditions de l'action à leur propos. Voici quelques exemples de chacune de ces trois nouveautés interdépendantes :

a- Les situations analysées révèlent un changement dans les foyers migratoires. Certains pays du Sud sont considérés comme des centres d'attraction (Corée, Taiwan, Hong Kong) tandis que d'autres du Nord ou du monde occidental deviennent des lieux d'émigration (Russie et Afrique du Sud). Cela distingue évidemment la géopolitique des flux de personnels scientifiques d'aujourd'hui de celle d'hier : l'orientation Sud-Nord, longtemps considérée irréversible, n'est plus une réalité absolue.

b- La terminologie autour du concept même de migration est sérieusement démultipliée : Pendant ce symposium sont apparus et ont proliféré des termes plus ou moins nouveaux, là où auparavant le concept de *brain drain* aurait seul prévalu. Il s'agit donc d'un renouvellement notable de la problématique du champ d'étude. Certes il y a le ***brain gain***, la récupération des talents par les programmes de retour ou autres (Narvaez Berthelemot, Rosas ; Pifat, Cano ; Pedersen, Lee ; Song ; Zhong) mais aussi le terme de **mobilité** qui définit une appréhension intrinsèquement circulatoire et dynamique de l'activité scientifique (Charum ; Murcia, Parrado ; Vessuri), celui de **diaspora** qui capitalise sur la dispersion au lieu de s'en affliger (Belgacem, de la Vega, Montenegro, etc.), celui des **objets psychanalytiques transitionnels** qui permettent l'identification positive et créatrice de l'intelligence expatriée à une communauté (Miramon), celui de **centre et périphérie** qui n'est plus structurel et incontournable mais conjoncturel et manipulable par l'acteur (Martin Rovet, Carlson) et il y a même le terme d'**astronaute** qui réfère à l'apesanteur récurrente des détenteurs de compétences en mouvement

quasi perpétuel (Zhong). C'est là une polyphonie conceptuelle qui enrichit singulièrement le débat sur le phénomène migratoire intellectuel et fournit des cadres d'interprétations beaucoup moins univoques qu'auparavant.

c- Le symposium témoigne également d'une évolution des attitudes, des stratégies et des politiques vis-à-vis des migrations de scientifiques. On parle moins de conditions macroscopiques qui surdétermineraient impérativement l'activité scientifique, telles que la situation économique ou politique globale et on s'attache plus à rechercher des solutions en rapport avec le marché local du travail (Kitova, Kouznetsova), l'installation de masses critiques où puisse prendre cette activité (Barreiro et Velho), en tissant des réseaux suceptibles de capter les ressources humaines ou matérielles en densifiant le tissu scientifique local ou en l'étendant au monde pour stimuler le retour ou démultiplier la capacité limitée (Toren ; Krishna ; Dezhina, Meyer et Granès).

L'option diaspora

La présentation et la description détaillée de l'option diaspora constitue un apport extrêmement concret du symposium et elle représente sûrement un thème durable d'échanges et de coopération entre les participants.

Les rapporteurs viennent de nous révéler à quel point la configuration en diaspora de la communauté scientifique était pressentie comme une forme prometteuse pour élargir la base et démultiplier la capacité intellectuelle d'un pays.

Le fait significatif c'est que dans des régions du monde aussi différentes que la Croatie, le Maghreb, l'Amérique centrale, le Chili, le Venezuela, l'Uruguay, la Chine, la région Amérique latine dans son ensemble, apparaissent au même moment, sans concertation et de façon spontanée, la même orientation stratégique de mobilisation des compétences situées à l'extérieur du pays ou de la région.

Cela ressemble à ces découvertes expérimentales, concommitantes mais indépendantes, que réalisent en même temps dans différents points du globe des équipes distinctes qui ensuite s'en disputent la paternité. Kuhn explique cela très bien par l'existence d'un même paradigme qui oriente les problématiques, les méthodes heuristiques et les procèdures de recherche au delà même de la conscience des acteurs et les fait aboutir au même résultat à peu près en même temps....

Sommes-nous donc à l'aube d'un nouveau paradigme dans la géopolitique des migrations scientifiques et susceptible de remplacer celui du *brain drai*n disqualifié par son inopérance dans le contexte de la société globale contemporaine ?

Il y a deux ans, à Paris dans une rencontre comme celle-ci, nous avions présenté une réfutation théorique du *brain drain* en démontrant qu'il était basé sur un principe atomiste établi sur des prémisses économicistes ou mécanistes. Dans sa version économiciste, celle des internationalistes, le cerveau est mû par la loi de l'offre et de la demande, sur un marché international des compétences qui préside instantanément, de façon transparente et fluide, à son allocation optimale. Dans sa version mécaniste, celle des nationalistes, la demande et l'offre sont remplacées par le centre et la périphérie, et le cerveau est soumis à une force d'attraction pure et simple (Meyer et Charum 1994, 1995).

Ces deux versions supposent une individualité et une intercheangeabilité des compétences dont nous avions prouvé qu'elle est purement fictive : la compétence ne vaut jamais seule mais tou-

jours associée à des entités sans lesquelles elle n'est jamais réalisée. Plusieurs écoles le révèlent sans ambiguité : l'école mertonienne qui souligne l'activité scientifique comme un fait collectif, institutionnel et jamais individuel. L'école khunienne qui renforce la communauté mertonienne d'une dimension cognitive : le cerveau ne peut penser sans être inscrit dans un cadre collectivement construit, le paradigme. L'école relativiste accentue encore le trait en montrant comment les savoirs tacites résultant de l'apprentissage prolongé, ce que Harry Collins appelle l'enculturation, sont indispensables au travail expérimental. Enfin l'école relationniste insiste sur l'association du cerveau avec de multiples dispositifs sociaux et techniques, à l'intérieur et à l'extérieur du laboratoire, pour qu'il puisse développer une action effective.

Le cerveau ne se déplace pas dans un vide absolu entre des polarités différentes mais à l'intérieur de réseaux le reliant à de multiples entités par lequelles il circule et parfois s'installe dans une configuration stable. Ce n'est pas là une considération triviale ou spéculative. Elle détermine fondamentalement les stratégies de *brain gain* depuis quelques années.

Le *brain gain* se développe selon 2 options : l'option retour et l'option diaspora. La première suppose que l'on reconstitue localement un treillis dense de relations et de ressources, un tissu réceptif, pour que l'activité du chercheur rappatrié puisse prendre.

La réussite de la Corée dans ce domaine n'est pas peu significative. Nous avons vu que le succès de sa stratégie *brain gain* est lié à la création et au développement d'une infrastructure de R & D, S & T, consistantes (Song). Nous pourrions donc appeler cette version du *brain gain* : version structurelle, puisqu'elle fonde la structure, par décision politique, pour insérer le talent.

La seconde, l'option diaspora serait une version réticulaire (de réseau) puisqu'elle entend mobiliser et instaurer des liens entre des entités préexistantes dont elle réorganise les associations pour son projet, lui aussi défini par décision politique. Cette option est particulièrement féconde parce qu'elle dispense, pour la réaliser, de préconditions lourdes en ce qui concerne les ressources et les investissements. Les connaissances, les équipements, les infrastructures sont déjà à côté des personnes, des acteurs du réseau.

Sans vouloir ériger cette option diaspora en modèle nous avions proposé d'en définir un *modus operandi*, il y a deux ans, en la testant sur le cas colombien du réseau Caldas (Gaillard and Meyer 1995).

C'est ce que nous avons fait et c'est une petite partie des résultats de ce travail qui a été présentée dans ce symposium. Ces résultats prouvent que l'option diaspora n'est plus une hypothèse mais une réalité. Nous savons maintenant pourquoi et comment elle fonctionne -plus ou moins bien- et nous pouvons indiquer le chemin à suivre pour la développer au mieux.

En particulier, les indicateurs qui ont été présentés et expliqués sont des instruments de décision très puissants (Charum ; Montenegro). En effet, le problème majeur de l'option diaspora c'est sa dispersion intrinsèque qui nuit à l'agrégation, à l'installation de masses qualitatives critiques qui puissent permettre le développement d'activités de recherche multilocales.

Or, nous avons constaté, par exemple, que les clusters thématiques définis à partir de l'enquête colombienne permettent d'identifier rigoureusement la localisation de compétences compatibles et convergentes, dans le monde hétérogène et dispersé de la diaspora. Ces méthodes agissent donc un peu comme des capteurs sensitifs : elles repèrent les voisinages possibles dans une multitude de descripteurs particuliers et opèrent les agrégations virtuellement fécondes... La diaspora se présente alors sous la forme d'un hypertexte dans lequel un observateur navigue pour chercher quels interlocuteurs l'intéressent pour un projet particulier. Cet observateur peut être un ministre de la recherche, un responsable d'institution, un chercheur individuel même. Imaginez un tel outil à la disposition d'une politique pour sélectionner ses priorités en fonction des meilleures disponibilités et des objectifs que se fixe la société qu'elle conduit !

Un des résultats massifs du symposium c'est d'avoir commencé d'échanger non seulement des questions et des informations mais aussi, déjà, des réponses utiles aux uns et aux autres. Le cas colombien permet aujourd'hui, aux autres cas d'option diaspora évoqués dans le courant du symposium, de s'appuyer sur une expérience concrète, perfectible certes mais d'ores et déjà reproductible. Bien entendu, il ne s'agit guère d'outils routinisés : ils requièrent un travail permanent de recherche. C'est justement cela la vocation du satellite : partager ce travail de recherche non pas de façon sporadique mais continu. Nous sommes là engagés dans une oeuvre aux enjeux importants puisqu'il s'agit de la circulation mondiale des connaissances et des compétences. Il y a énormément de situations à approfondir, de concepts à développer et de de méthodes à proposer. Nous avons ici commencé ce travail, nous avons lancé le satellite, il faudra maintenant le maintenir en orbite.

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Conclusion

Guillermo Paramo Rocha

Often I have discussed an image from the Japanese film Woman in the Dunes. It is an extraordinarily powerful image. The film's opening shots are of a man in western dress walking through a desert landscape, in the sand dunes of some Japanese island. This tired person, wiping away his sweat, stumbling, is armed with a camera, a blanket and a butterfly net. He captures an insect, photographs it and continues on his way. Later, this person is caught by the local villagers and forced to marry a local woman, from a village that is like an oasis in the midst of the sand. The film tells the story of the man's attempts to escape this prison and forced marriage. This film is beautifully shot in strong blacks and whites, like Japanese calligraphy. It is reminiscent of the universal drama and anyone can see the cosmic struggles reflected in it. Clearly, It is also the simple story of the adventures of this person, but the whole argument turns on the apparently insignificant fact of having photographed an insect. The insect that was photographed is a Japanese cicindela or Tiger Beetle which is known among entomologists because when it is in the larva state it digs a narrow pit in the sand and from there it lies in wait for insects which it captures. It then drags its prey into the depths of the pit to be devoured. Naturally the insignificant act of photographing the microcosmic world of this insect is translated into the macrocosmic world of the film and its plot.

I have repeated this story many times, this Japanese haiku, because the significance of photographing the insect is only recognized by someone who knows about insects, by the entomologists who see the film, not by other spectators who fail to appreciate it and generally discount it to the same level of significance as the act of wiping away sweat or stumbling. An entomologist will recognize the cosmic drama in this act. A scientist is someone who has the capacity to recognize cosmic dramas in specific fields. And in this sense, he lives in his own world : a world that is revealed by facts that others do not perceive. This is the way scientists are. The entomologist sees a world where other people just see bugs. Astronomers see distances, luminous bodies, constellations, times, and processes whereas other people just see a starry night. Linguists see patterns where others do not note any differences. Scientists live in independent worlds. Of course cultures also exist this way, even more so than scientists. If scientists within our own culture live in their own world, then this is even more true of cultures, cultures are traditions, ways of seeing, facts, ways of classifying, languages, inheritances, relations that others cannot see. The dream of science, the dream of knowledge, maybe our culture's dream is to meld, to meld these experiences, to arrive at a common experience, to participate, to know, to understand. The job of science would appear to be that of understanding, to go beyond the established boundaries, to break those bounds, to colonize, to conquer and to connect. Art also functions this way in our world. Art does not simply capture the world, it produces it, fabricates it, creates it, purports to connect it. The dream of our time is this connection. Perhaps it is an impossible dream because while specialization is taking place this dream would appear to be a paradox : the scientist creates an object that as it becomes more advanced, becomes more exclusive. But at the same time it is not completely scientific if it does not share, does not communicate, is not part of the universe where its particular world communicates and disseminates. Scientific migration is a fundamental process in this dream of science and maybe western science would not exist, maybe science itself would not exist, were it not for the physical pro-

cesses of intellectual migration. Einstein, Enrico Fermi, Freud, Carnap, like so many others, Kandinski, Sagal, Stravinsky, and Chagall were all intellectual immigrants. They were beings who were able to transport their cultural experiences, linked to their scientific knowledge or their capacity to produce art and culture, and with this they were able to move from place to place, sometimes buffeted by the political or economic problems of the time, and they were able to revitalize and perhaps fertilize a different hemisphere with a new experience and way of thinking. For us as Latin Americans and particularly for Colombians who have been or tend to be an inward looking nation, being an Andean republic bordered by jungles and oceans, this intellectual migration process is fundamental. Many of our best professionals have come from other places not because we could not produce very good professors but because no man can live in the singularity of his cultural experience without being reduced, without being limited. Our country has not witnessed much cultural immigration and maybe because of this we tend to overestimate what is taking place out of our sight. Vico said that a man's prestige is inversely proportional to his distance – however, to contradict Vico – it is also directly proportional to that distance. Vico thought that prestige was diminished with distance, but sometimes another form of prestige arises and I believe that with science, above all in a country like Colombia, both processes are needed. There is a need to discover in the man who produces science or who produces art, the creator, the creator to be respected and admired, the surprising creator, the creator. But equally, one needs to discover in the creator, the man, the ordinary man, the humble man, the man, the man like everyman. Colombians and Latin Americans who have lived on this side of the Atlantic need to discover in ourselves the ability to create and in this it is indispensable to know that there are others like us. Cultural migration is a process that is sometimes not contemplated with sufficient interest in countries like ours, it is simply ignored. Other Latin American countries have been much more open to intellectual migration : Mexico, Argentina, Brazil. Colombia has been a distant, distanced country. I would like to take this opportunity to salute this initiative in itself : the fact that there are Colombians and people who come from other countries who think with us in this situation, at a time of one of the greatest intellectual migrations since the post-Second World War period. Once again, this is a time in which political changes and economic changes have uprooted scientists and artists, who have moved on to new pastures. Colombia and Latin America need to think about this process. I wish to congratulate the organizers of this event, to thank you for your interest in these issues and I hope that our field and our knowledge will manage or strive to make this dream of conceiving of the universal come true. Thank you very much.

Conclusión

Guillermo Paramo Rocha

Muchas gracias. He repetido muchas veces una imagen de una película japonesa que se llama Una Mujer de la Arena. Es una imagen extraordinariamente fuerte. En las tomas iniciales de la película se ve a un hombre vestido a la usanza occidental caminando por un paisaje desértico, en medio de dunas de arena en alguna isla del Japón. Ese personaje fatigado de vez en cuando se enjuga el sudor, tropieza, va armado con una cámara fotográfica y con una manta y una red de cazar insectos. En algún instante captura a un insecto después de fotografiarlo y sigue su caminar. Más adelante, ese personaje es atrapado por unos indígenas del lugar y convertido en el esposo de una mujer de la aldea, una aldea que es como un pozo en medio de la arena. Y el drama de la película es el de ese personaje tratando de escapar de esa prisión y de ese matrimonio forzado. La película está maravillosamente descrita con una fotografía de fuertes tonos negros sobre blancos como los caracteres japoneses. Quizá remite a un drama universal y quienquiera puede ver en eso una lucha cósmica. También es clara la aventura simple de ese personaje, pero toda la historia está metida en el acto aparentemente insignificante de haber fotografiado el insecto. El insecto fotografiado es una cicindela, una *cicindela japonica* que es conocida por los entomólogos porque, en estado larval, hace un pequeño agujero en la arena y desde allí acecha a los insectos que pasan por el vecindario y los captura y se los lleva para devorarlos al fondo de su minúsculo agujero. Naturalmente ese acto insignificante de fotografiar el insecto en ese nivel microcósmico encierra el mundo macrocósmico de la película y del drama.

Pero he repetido tantas veces ese hecho, ese haiku japonés, porque el hecho de fotografiar el insecto sólo es advertido por aquel que sepa de insectos, por los entomólogos que asisten a la película, no por los otros asistentes que lo pasan desapercibido y generalmente lo reducen a lo mismo que el acto de enjugarse el sudor o tropezar. Quien es un entomólogo descubre en ese hecho un drama cósmico. Un científico es un ser que tiene la capacidad de descubrir dramas cósmicos, según su campo de interés. Y en ese sentido viven en algo así como en un mundo propio. El mundo que se le revela en datos que otras personas no perciben. Y así son todos los científicos. El entomólogo ve un mundo donde los otros no ven sino bichos. Los astrónomos ven distancias, luminosidades, constelaciones, tiempos, procesos donde los demás ven apenas una noche estrellada. Los lingüistas perciben matices donde los demás no captan diferencias. Los científicos viven en mundos independientes. Naturalmente así viven también las culturas mucho más que los científicos. Si los científicos dentro de nuestra propia cultura viven en mundos independientes, mucho más las culturas, las culturas son tradiciones, formas de ver, datos, maneras de clasificar lenguajes, herencias, relaciones que otros no establecen. El sueño de la ciencia, el sueño del conocimiento, quizás el sueño de nuestra cultura es fundir, fundir esas experiencias, llegar a una común experiencia, participar, conocer, comprender, la tarea de la ciencia parece ser la de comprender, la de ir más allá de las fronteras de lo establecido, romper las fronteras, colonizar conquistar y vincular. También así en nuestro mundo el arte -el arte que no simplemente capta el mundo sino que lo produce, lo fabrica, lo crea- pretende vincular. El sueño de nuestra época es el de la vinculación. Tal vez un sueño imposible porque, en la medida en que la especialización se da, ese sueño parece paradójico : el científico fabrica un objeto que cuanto más avanzado es más le pertenece en exclusividad, pero al tiempo no es científico plenamente si no comparte, si no comunica, si no forma parte de un universo donde su mundo particular se comunica, se diluye. Las migraciones científicas son procesos fundamentales en ese

sueño de la ciencia y tal vez la ciencia occidental no existiría, la ciencia misma no existiría si se le desvinculara de los procesos físicos de la migración intelectual. Einstein, Enrico Fermi, Freud, o Carnap, o tanto otros, o Kandinski o Sagal o Stravinsky o Chagall son inmigrantes intelectuales, son seres que pudieron transportar su experiencia cultural ligada a su conocimiento científico o a su capacidad de producir arte y cultura y con ese trasladarse de lugar a lugar a veces fustigados pro los problemas de la política o de la economía de su momento, fueron capaces de vivificar y, tal vez, de fecundar un hemisferio distinto con una experiencia nueva y una manera de pensar. Para nosotros, los latinoamericanos y particularmente para los colombianos que hemos sido o tendido a ser una nación metida en nosotros mismos, a ser una república andina rodeada de selvas y de mares, ese proceso de migración intelectual es fundamental. Muchos de nuestros mejores profesores han venido de otros lugares no porque no podamos producir muy buenos profesores sino porque ningún hombre puede vivir en la singularidad de su experiencia cultural sin ser reducido, sin ser limitado, pero no hemos tenido muchos inmigrantes culturales en nuestro país y tendemos quizá por eso mismo a sobreestimar lo que pasa más allá de lo que alcanzamos a ver. Recuerdo que Vico decía que el prestigio de un hombre era directamente proporcional a la distancia que nos separaba de él. Pero a veces el prestigio de un hombre -contradiciendo a Vico- también es directamente proporcional a la distancia que nos une a él. Vico pensaba en que el prestigio se reducía con la distancia, pero a veces aparece otra forma de prestigio y yo creo que la ciencia, sobre todo en un país como Colombia necesita de ambos procesos, Necesita descubrir en el hombre que produce ciencia o que produce arte, el creador, el creador que respetar y admirar, el creador sorprendente, el creador. Pero, igualmente, necesita descubrir en el creador el hombre, el hombre ordinario, el hombre sencillo, el hombre, el hombre como cualquier hombre. Los colombianos y los latinoamericanos que hemos vivido en este lado del Atlántico necesitamos descubrir en nosotros mismos la capacidad de crear y para eso es indispensable que descubramos que los otros son como nosotros. Los procesos de migración cultural son procesos que a veces no se atienden con suficiente interés en países como el nuestro, se ven pasar. Otros países de América latina han sido mucho más abiertos a las migraciones intelectuales, México, Argentina, Brasil. Colombia ha sido un país distante, distanciado. Yo quiero en esta oportunidad saludar esta iniciativa misma : el hecho de que haya colombianos y personas que llegan de otros países que piensan con nosotros en esta situación, en el momento en el cual ocurre una de las más grandes migraciones intelectuales que se han producido después de la segunda guerra mundial. Este es un momento en el cual los cambios políticos, nuevamente, y los cambios económicos han desarraigado científicos y artistas que se han trasladado a otros escenarios en donde a su vez, como en una reacción en cadena han desarraigado nuevos científicos y artistas que se han trasladado a otros campos. Colombia y América Latina necesitan pensar en este proceso. Quiero pues felicitar a los organizadores de este encuentro, agradecer a ustedes su interés en estos temas y procurar que ojalá desde nuestro campo y de nuestro conocimiento, desde esa esfera singular en donde se mueve la ciencia y donde se mueve el arte, podamos cumplir o por lo menos pretendamos llenar ese sueño de concebir lo universal. Muchas gracias.

Abstracts

3- Policies and programmes on qualified human resources migrations

Lelio Mármora

The phenomenon of offshore production with the resulting growth of transnational corporations, the economic development of some countries, the increasing changes in the methods of production and the new communication structures are elements that have determined a boost in qualified human resources (QHR) mobility. Though, quantitatively, this boost represents only part of international migrations, it has a significant importance because of its costs and profits, both at a public and at a private level.

For its part, the theory on migrations has been strongly affected by this often short-lasting movements, which has led to the need of rethinking the meaning of those movements and the very relevance of the " migration " concept. The questioning and reflection about these elements constitute the foundations of this article in its various parts. First, we shall analyze the conceptual implications of the terms : " brain drain ", " competencies exodus ", " reverse transfer of technology " and " skill exchange ", and the relations of these terms with the migration processes. Secondly, we shall present some reflections regarding the cost-benefit ratio of the QHR migrations, and the role of this relation in the determination of the migration policies.

Third, we shall deal with the different public policies and programs on QHR migrations, such as those on retention and recuperation of qualified migrants, as well as on regulation and decontrol of migrations. Fourth, we shall analyze the evolution of private policies concerning this issue.

4- International migration of highly qualified people: A bibliographic and conceptual analysis

Anne Marie Gaillard, Jacques Gaillard

A bibliographic corpus of 1808 references of studies written from 1954 to 1995 and strictly dealing with the international migrations of highly qualified people was established and gathered in a database, obtained from different documentary sources (among which are seven databases and ten bibliographies already existing).

This communication deals with the characteristics of the identified studies. Classic bibliometric indicators such as chronology of publications, the identification of most prolific authors and references of the main journal and of the key institutions will allow a mapping of the interest given to the theme during the relevant period.

A qualitative approach made possible thanks to the analysis of a group of indicators such as the countries implied by the studies, the nature of the publications and the themes will allow the differentiation of the levels of interest given to the matter as the time went by. Observation will thus be made upon how the problem of migrations of highly qualified people, first considered through the migration of students as a positive phenomenon, that allows a transfer of technology from rich countries to poor countries (taking for granted that students return to their countries after their emigration) was afterwards perceived as a severe loss for the emigration country, when it was hinted that the students might not return. On this basis, this topic has become one of the most controversial theoretical issues (in terms of "who loses and who wins") in the decade of the '70s and then a work subject of international conferences about development, but since the end of the '80s it again acquired a posi-

tive nature in a context of exchange globalization in which such migrations began to appear as a potentially beneficial phenomenon for the emigration country.

In addition to these results, the objective of this communication is to introduce a tool : the bibliography itself, which represents a solid scientific basis for those who wish to have a deeper knowledge of the field and represents one of the basic elements to verify the "state of the art" on the subject of international migrations of highly qualified people.

5- Brain drain: an historical and conceptual framework

Enrique Oteiza

In order to understand the specific nature of this type of contemporary selective emigration (part of the so-called brain drain) and to grasp its differences with other migratory phenomena, it is useful to review the pertinent historical background. In the history of Science and University, according to well-known texts, such as those by G. Sarton, C. A. Parsons, F. Ii. Powicke, H. Waddell and others, two important aspects of scientists and intellectuals migrations out stand. The first one concerns the high mobility of these people compared to other groups of their respective societies of origin. The second one is the role played in this movements by explicit policies for attracting these migrants. It can be noted, though, that the present phenomenon of brain drain differs from previous similar migratory processes. The former has permitted some countries to incorporate, in the last fifty years, hundreds of thousands of highly qualified immigrants. On the other hand, in a similar period of time, the latter has involved, at the most, a few hundreds of prominent personalities of the intellectual and scientific world at that time.

It is from World War I on that countries of destination of the main international migratory flows, according to each country's interests, begin to define and apply policies aiming at retaining or attracting people with certain qualifications, including scientists. From World War II on, migratory policies became more clear, as far as high level scientific and technical personnel is concerned. The countries with the highest relative development, that is the industrially and scientifically advanced countries, hold a certain attraction through multiple mechanisms that allow them to design and implement selective migratory policies. In this presentation we shall examine, as well, the characteristics of the different stages through which the system of selective migration has evolved since World War II.

6- Migration of scientists in the history of science in totalitarian societies

Yakov M. Rabkin

Transitions to and from a totalitarian system of research may result in migrations of scientists. This paper examines migrations of scientists in a comparative perspective, looking primarily at three European countries that experienced totalitarian regimes and, at the same time, possessed a developed research infrastructures and world renowned scientists : the Soviet Union, Mussolini's Italy and Hitler's Germany.

This research is informed by the following preliminary considerations. For the purposes of this research the term " totalitarian " refers to societies which experienced attempts of " total control " in the course of the 20th century. This concept is controversial, and has been often used polemically. However, recent works on the nature of Soviet and German varieties of totalitarianism continue to resort to this concept. Moreover, a pronounced scholarly interest in totalitarianism, including studies of totalitarianism and science, has emerged all over Eastern Europe since the 1980s. In this project the

term “ science ” includes mainly natural, medical and exact sciences. The emphasis on the natural sciences is motivated by an admittedly more transnational character of scientific knowledge in these sciences and the concomitant identification with scientific internationalism by many scientists working in them.

Science and totalitarianism need not be viewed as a victim and a victimizer, a dichotomy that informed a good part of the existing literature on the subject. Both engage in conflict and reinforce each other. The roles of science in the shaping of the political outline of this century deserve to be explored, particularly since science is often neglected as a building block of totalitarian ideologies.

The exodus of scientists from totalitarian countries, and their relationship with the scientific community left behind is a phenomenon related to the issue of resistance vs collaboration. On the other hand, it is linked with the controversies surrounding international relations of science in totalitarian societies. All of these regimes put an emphasis on isolation and autarky, some explicitly differentiating between world science and the ideologically oriented science (“ German Physics ” or “ Marxist Biology ”) under a given regime. Yet science, primarily because of its strategic and diplomatic significance to the totalitarian leaders, was allowed (and occasionally even encouraged) to engage in foreign contacts, however restricted and manipulated.

7- Migration and construction of scientific cooperation The case of the Caldas network

Jorge Charum

The diaspora option is a new prospect for recovering science and technology (S & T) capacities of emigrated nationals. Unlike the “ brain gain ” option -which, so as to assure the reintegration of emigrated scientists and engineers to their country of origin, requires a more precise comprehension of the need of having at one’s disposal local structures of reception for the emigrated scientists and engineers- the diaspora option considers that the creation of cooperation and collaboration ties between the emigrated scientists and engineers with the national scientific community is more important than the physical return of those who have emigrated. These ties allow to generate a network of sociotechnical relations aiming at the creation of a national scientific capability, benefiting from the delocalized participation and contribution of the diaspora members. The network and its functioning are determined by : a) the action of multiple actors - researchers, research groups, national research programs, national and institutional policy makers - who from their particular position and their interests take part in the construction of a socio-technical network through which there is a circulation of people, projects, problems, equipment, documentation ; b) cooperation and collaboration between research actors settled both in and out of national boundaries, benefiting from the support of the research structures in which they are involved ; c) mobilization of knowledge and experiences gathered and obtained by emigrated scientists, which allow to design, undertake and maintain joint projects with the members of the domestic scientific community.

The Caldas Network is an example of this new prospect in the field of S & T. On the basis of the publications of the network emigrated members and the verification of their present research and work activities, it is possible to determine assembled knowledge and resources as well as potentialities for cooperation in specific areas. The interviews carried out permitted to characterise different types of actors and ways of participating in the network construction and in the generation of its dynamics. The updated knowledge of the above-mentioned elements can be very useful in determining the guidelines for the national and institutional policies and for the strategic decisions in the field of research.

8- Collegial networks and the integration of Russian immigrant scientists in Israël

Nina Toren

Two kinds of networks of Russian scientists who have recently immigrated to Israel are analyzed and compared. The first type is composed of other scientists, named by the scientists investigated, as having influenced their research intellectually. The second type of network includes other scientists who helped in professional matters, such as using new research techniques and connecting newcomers to scientists and institutions in the new environment. These networks differ in structure and content, however both are important for sustained research productivity and the integration of immigrant scientists into a new scientific community and research system.

9- Brain drain, brain gain and scientific communities: Indian experience in the field of biotechnology

Venni V. Krishna

Ever since the developing countries such as India embarked on building modern S & T institutional infrastructure, the problems associated with the process of brain drain became a stumbling block in building local-national S & T capacities for development in many emerging fields of research. Indian experience shows that training sophisticated S & T personnel without the existence of a certain viable number of research groups or specialist communities, in the sociological sense of the term, in the first instance, results in the migration of trained scientists to places which offer a better professional climate and have a demand for intellectual capacities. As a corollary to this, the status of scientific communities and the professionalisation of science and technology fields of research is closely associated with the phenomena of brain drain and brain gain, these two features being the two sides of the same “ coin ”. The promotion and growth of a professional scientific community or specialist groups in a given area of science not only checks the process of drain but given the professional climate and an intellectual context, generates the potential to attract return migration of scientists. This finding emerges from the preliminary empirical study undertaken in some selected research groups in the leading scientific institutions. Case studies undertaken on molecular biology, biotechnology and telecommunications research groups further reveal that there are different modes of professionalisation associated with the “ science ” oriented and “ industry ” oriented fields of S & T with deeper implications for understanding the phenomena of drain and gain.

For a science oriented field such as molecular biology, there are crucial elements that act as indicators of this mode of professionalisation : the emergence of a certain viable number of specialist groups, relevant university courses at the doctoral level, professional societies and channels of communication (this is to say, journals) within the country, the interaction of local scientists with international researchers, interaction with international groups through students and communications and by receiving recognition and legitimacy from the national funding channels. Scientific publications and research relevant to the cutting edge of the field are important elements in the science oriented fields of research such as molecular biology. On the other hand, for an industry driven field such as the telecommunications research groups, the mode of professionalisation entails dissemination activities. Creating a demand for research in the industry, including trained personnel, patents in the relevant field of research, the significance of designs, processes, instruments and blueprints, etc. — these demonstrate different elements of this mode of professionalisation. The paper maps out three fields of S & T in the Indian context over the last decade and relates the understanding of professionalisation to the phenomena of drain and gain. In doing so, the paper also attempts to bring out certain policy implications relevant for the developing countries.

10- The “brain gain” in the Mexican scientific community: an alternative outlook

Nora Narvaez-Berthelemot, Angélica María Rosas

The migration of scientists from developing to developed countries has been the subject of numerous studies. The brain drain of scientists has also been considered to be one of the indicators of the level of a national scientific community’s development, testifying to its member’s adaptability, degree of creativity and the need to look elsewhere for the right conditions to carry out research in specialized areas. Nevertheless, it should be noted that countries like Mexico have welcomed foreign scientists who play an important role in the development of the national scientific community, while not precisely substituting for those nationals who have emigrated.

The immigration of scientists from countries of a different scientific level could be an alternative method of strengthening that country’s scientific potential. In this study we examine that possibility using data on the members of Mexico’s System of National Researchers (Sistema Nacional de Investigadores - SNI). We analyze the participation of foreign scientists in the SNI, their production, development and contribution to their scientific fields.

11- Implications of scientific mobility between France and the United States

Timothy Carlson, Dominique Martin-Rovet

Each year, five thousand young French scientists cross the Atlantic in order to pursue graduate and doctoral studies in the United States, and to do other post-doctoral studies. On the other hand, practically no U.S. students go to France for an advanced degree and there are no more than about a hundred who come to do post-doctoral research. This figure would be about the double if one would to take into account U.S. scientists who, in mid-career, come to work in a French laboratory for a short period of time

This situation in the scientific field is the reverse of what it is in the arts : waves of U.S. students (about 3,000) come to pursue undergraduate studies in arts which last one year or more. To this somewhat troubling scenario we must add another disconcerting element ; while the United States has the reputation of receiving foreign students with open arms, in fact France receives relatively more foreign students than the United States, with respect to the total student population. And though there is a grain of truth therein, we cannot simply say that U.S. scientists are allergic to foreign languages. When considering their international mobility (including travel to English speaking countries), we cannot ignore the fact that their mobility is poor in relation to that of the European countries.

Through surveys that have already been published (*see Bibliographie*), the importance of the researchers’notion of freedom is apparent. This leads us to explain the problems against which most scientists struggle, to maintain their independence, to use the scientific profession as a framework for reflection, that is the delivery by a specialist of services in exchange for remuneration and privileges. Autonomous research is, in many ways, less autonomous when it becomes professionally retributed services. It is interesting to note that the same leitmotif has always existed: to cross the Atlantic Ocean gives the scientist a greater freedom in his research. Many French researchers have found more freedom for research in the United States, and in France a certain number of U.S. researchers have had the same experience.

As well as the concepts of professionalization of science, of career, of independence which are sometimes opposed and always subjected to the political pressures of the social environment, we must add the various perceptions of the “ center and periphery ” of science. Nothing is truly simple, and direct causality does not contribute to the analysis. This is what we will try to show in this paper.

12- Patterns of collaboration of scientists at the National University of Mexico (UNAM)

Jane M. Russell, Margarita Almada de Ascencio

An analysis of the coauthorship patterns of papers published between 1980 and 1994 by 15 highly productive Mexican scientists in five different fields from the mega National University of Mexico (UNAM) indicated that all were global collaborators, showing formal collaboration with both national and international peers. Results also identified important collaborations with colleagues from the UNAM, suggesting that these highly visible scientists form part of established groups of researchers within their own institution. The group of six researchers in the basic science fields of physics, and astronomy and astrophysics showed the highest levels of international collaboration. These levels bore a direct relationship to the total number of papers published by this group suggesting that international activities are important for scientific performance. A case study of one of the physicist suggests that international coauthorship can lead to increased international impact as measured by citations, as well as indicating the important role that sabbatical leaves of absence play in this process.

13- The emigration of Argentine scientists: the case of Conicet

Celina A. Lértora Mendoza

This paper illustrates the “ brain drain ” process from this institution. Conicet was founded in 1958, modeled on the French Council, and its intent with the purpose of creating a national body of scientific excellence.

Conicet’s efforts and investments to develop a highly qualified body of researchers were somewhat ill-fated because of emigration. In providing a general overview, I attempt :

1. To outline a statistical analysis of the flow, to the extent that data is available (the institution’s archives are not complete).

2. To determine the causes of departure, which -provisionally- are thought to be: a. Outside pressure factors (political and economic); b. Difficulties in the scientific system itself in providing researchers with adequate conditions; c. Alternative offers and changes in mentality.

Because of the gravity of emigration during 1973-1977, in 1984-1986, for the first time, a policy for repatriation was implemented. Its results have been interpreted differently. The data is not exhaustive, but does show that the response was small and a considerable percentage of those who returned did not manage to find adequate local placements and they re-emigrated.

Faced with this reality, in the near future, other studies should be done on the results of an alternative program that Conicet began to implement a few years ago which consists of establishing an organized flow of intellectual exchange between Argentine researchers living in the country and those resident abroad. The paper analyses the two basic conditions that must be met: a) sufficient homogeneity between the two communities and b) social expansion of the specific research interests.

14- Scientists migration in Chile, 1973-1990

Manuel Jiménez

The reasons for scientists’migration during this period in Chile, are related to three main issues : firstly, the scientists’low salaries, mainly at universities, the institutions that employ most scientists in Chile ; secondly, the scarcity of sophisticated equipment required for work in some fields ; and thirdly political reasons related to the military government.

Traditionally, the government and the universities have attempted to control scientists'migration by means of : (a) legal regulations and clauses in work contracts ; (b) providing more facilities and upgrading scientific equipment in some fields ; (c) improving the contact of Chilean scientists with peers around the world ; (d) placing high value on research that is related to the academic career ; and (e) by creating a fund to finance scientific research, which includes a considerable sum of money to increase scientists'salaries.

The Chilean government, during this period, developed a number of instruments to control scientists'migration, and had some success in diminishing this problem. As well, in accordance with the government, Chilean private foundations developed regulations to oblige grantees to return after their postgraduate training.

The universities were very limited in their ability to offer jobs, especially to young scientists in the area of hard sciences, and this was the main reason for the migration of these highly qualified people. The other potential employer for scientists, namely industry, did not have a 'research culture', in neither the pure nor the applied sciences. They would contract research through the universities when they needed help.

The evolution of employment in the field of social sciences, and the role of foreign foundations for social research is extremely interesting. Social sciences funding increased to levels previously unknown in Chile during the period under study, providing plenty of jobs and helping to diminish migration in this area.

Despite, administrative and legal devices to discourage scientists'migration, as a group, young, promising researchers are prone to migrate. Normally they are free from ties with the government or the universities. Most of them recently received Ph.D.'s on their own or with funding from national or foreign institutions which did not include compulsory clauses to return to Chile. Therefore, they are free to migrate.

The other group prone to migrate is people with good records as scientists. This group has two kinds of links abroad : (a) personal friendships with senior scientists abroad ; and (b) shared research interests, and a good level of contact with teams of researchers located in foreign countries.

This paper will look at two main aspects of scientific migration ; (1) the role and effect of legal restrictions, and incentives to avoid scientists'migration ; (2) a broad quantification of the numbers and reasons why senior and young scientists migrated in the period under study.

15- Scientific migration in Russia in the early 1990's: Scale, structure and consequences

Galina Kitova

1. Dynamics of R & D personnel in Russia and approaches to scientific migration studies

For many decades the number of R & D personnel in the former USSR, and particularly in Russia, constantly increased. Throughout the late 1980's the rate of increase lessened perceptibly and in the early 1990's the diminishment of R & D personnel in Russia became absolute. The approaches to analyzing this process remained practically unchanged until 1992. The essence of the analysis was limited to the calculation of indicators for the movement of R & D personnel.

The radical economic and political reforms in Russia in the early 1990's were implemented under global conditions of social and economic crisis. This crisis deeply affected the R & D field and abruptly changed the traditional mechanisms and tendencies for the development of R & D personnel. In 1992, when the total number of R & D personnel in Russia dropped by 26 %, the rigid dependence of the scope and structure of this indicator (the number of R & D per-

sonnel) on parameter of the personnel mobility (especially on the parameters of outflow of personnel from the R & D field) became obvious. As a result, Russian and foreign analysts began to investigate the processes of R & D personnel mobility in Russia. They started with the problem of the emigration of Russian scientists abroad and sounded an alarm. The analysis of this problem did not reflect its real scope and importance in Russia. Indeed, according to official Russian statistics, 426 scientists emigrated in 1993 for permanent residence abroad. But the total loss of scientists during that year was 17,000 persons.

2. Extent and structure of internal brain drain During 1992-1995, the outflow of R & D personnel from Russian significantly exceeded its inflow (by 3 times in 1992 and more than 2 times in the following years). The distribution of those who left different categories of R & D varied. A reduction in the relative number of researchers is the most noticeable change. This reduction can be explained, in part, by the fact that the economic crises made it more difficult for researchers to find new jobs suitable to their education and skills.

The fact that the outflow of auxiliary personnel and technicians was greater than that of researchers may be explained by the lesser " commitment " of the first two categories to the R & D field (in comparison with researchers). In addition, their qualifications, experience and skills allowed them to find higher-paid jobs outside of the R & D field and permitted them to adapt quickly to the new jobs.

The negative impact of the intensive outflow of these two categories of R & D personnel became clear by 1993. It led to a reduction of the number, complexity and quality of experiments and testing in Russian science. The remaining technicians and auxiliary personnel were gradually losing their skills. This also affected the quality and results of Russian R & D.

More than half of those who left science in 1992-1995 did so of their own will. This means that the reduction of R & D personnel during this period was spontaneous and that the government did not regulate this process, its extent and structure. This conclusion can be corroborated by the fact that during the period the relative share of dismissals owing to staff cutbacks declined. In accordance with Russian labour legislation, people can leave their work to transfer to another job. The relative share of these persons in the outflow from the R & D field decreased considerably.

3. Inflow of personnel to the R & D field

Inflow of personnel to the R & D field changed during this period too. First, the relative proportion of auxiliary personnel in the inflow increased. But this increase did not compensate for the absolute reduction of these persons in 1992. Second, if in 1992 about 50 % of the newcomers were engaged by the R & D organizations themselves ("engaged by the R & D organizations themselves " is the phrasing of Russian labour legislation), then in 1994 their share reached 70 %. Third, usually the personnel inflow to the R & D field includes those who have left their work (included R & D) to transfer within the R & D field (to other R & D organizations). Their share went down. Fourth, but maybe the most tragic for the future of Russian science, is the reduction in the inflow of graduates that year (it meant that, for example, in 1994 the proportion of those who graduated from institutions of the higher education that year was relatively fewer than in 1993). This shows that the traditional mechanism for reproducing and updating science personnel in Russia was severely damaged during the period. This change also demonstrates the aging of Russian R & D personnel.

4. Spatial mobility of R & D personnel Lacking direct, consolidated data on the spatial migration of R & D personnel, in Russia one can investigate this process either based on data of population migration, or by conducting large scale surveys.

The results of the former approach can be seen below, Russian statistics distinguish between three types of migration :

- intraregional,
- interregional (which reflects the redistribution of population within Russian regions),
- interrepublican (which demonstrates the population exchange between Russia and the former Soviet Republics). Estimates of R & D personnel migration in Russia have been made based on the presumption that each of the streams includes R & D personnel.

Intraregional migration of R & D personnel in Russia is a channel of outflow from science. During 1992-1995 the contribution of this channel to the total reduction of R & D personnel did not exceed 3 %. If we take into account the direction of interregional migration of the Russian population in the early 1990's (this flow consisted mainly of people who moved from newly-developing areas), and the professional composition of these migrants (there were almost no R & D personnel among them), interregional migration of R & D personnel can be estimated to account for a total reduction of about 5 %.

It is a well-known fact that after the break-up of the former USSR, the number of people who moved from the former republics to Russia has been much greater than those who left Russia to go to the former republics. A study of the educational background of these emigrants allows us to conclude that for Russia the loss of R & D personnel to this outflow has been insignificant.

As for the effect of R & D personnel inflow from the former republics, it almost does not depend on the number of those persons. Given the catastrophic decline in R & D in Russia (especially the reduction of R & D personnel), and the high level of actual and latent unemployment in Russian science, the arrivals from the former republics have practically no chance to find work in the Russian R & D field. But there are a few exceptions : Russian regions with limited R & D resources that lack or need highly qualified scientists.

16- International scientific migration: 25 years of Latin American scientific migration to Europe (France, 1970-1995)

Guillermo Lozano

The migration of Latin American scientists to Europe has created a scientific-technological potential that must be recognized in order to consolidate International Networks, taking a particular case, that of migration to France. Establishing the origins, disciplines and insertion strategies of the Latin American scientists and researchers in the French scientific community, permits the refinement through particular case processes of the instrument of analysis for the comprehension of the processes of international scientific migration.
In establishing a " profile ", a set of characteristics proper to the Latin American scientist within the French scientific community and in identifying the type of relation with the country of origin, we can determine more precisely the consolidation strategies of the International Networks of Latin American and Caribbean Scientists. Equally, in examining funding policies for human resources training in the Latin American region and the policies of France in its 1970-1995 cooperation programs, new bases will be established for designing financing policies for scientific and technological activities.

17- Brain drain: problem of contract migration in Russia

Tatyana Kouznetsova

The emigration of scientists (for training, long-term business trips, or contractual employment) is a basic form of international contact. It attests that the process of the international division of labour in the field of science & technology is becoming more pronounced. In Russia this process has had quite controversial effects.

Emigration of scientists or their leaving for long-term work abroad is still not a normal form of scientific exchange, it has all the cha-

racteristics of a one-way brain drain, a problem faced by many developing countries and countries of a transitional economy. In this case, the discourses about Russian scientists making world science richer are partly valid.

This report presents some results of a research on heads and staff members of academic institutes and State scientific centers. The research looks at scientists who worked on international projects abroad.

18- The reverse transfer of technology from Sub-saharan Africa: some lessons from a preliminary assessment of the Zimbabwean case

Bernard Ikubolajeh Logan

The reverse transfer of technology (Brain Drain) has reemerged as a serious development problem. For subsaharan Africa, it is a particulary problematic issue because of its low status in the international division of labor. Data from the US and Canada are used to make a case that the region seems to be losing a larger percentage of its qualified experts precisely when they are most needed to meet developmental goals back home. Major elements of the problem are discussed and some policy are recommended.

19- Migration of the professional, semi-professional and technical occupations in South Africa: past patterns, current trends and policy

David E. Kaplan

The patterns and causes of scientific migration to and from South Africa are complex. Both the “ attractions ” and the “ repulsions ” for scientific and technical persons to work in South Africa have been determined by a variety of political and economic factors. Nor have these been constant over time - as we shall see, these determinants have been changing and are subject, at least to some degree, to policy choices.

By way of introduction, the first part of this paper briefly outlines South Africa’s capacities in relation to science and technology. The contrast is drawn, most frequently, with the other African countries, since, as we shall see, scientific migrations as between South Africa and the rest of the African continent has assumed a special importance.

The second part of this paper attempts a “ first-cut ” examination of the empirical data on “ scientific ” migration to and from South Africa. A major qualification to make at the outset is that the data referred to here relate not to the migration of “ scientists ”, but rather to the category of “ Professional, semi-professional and technical occupations. ” Immigration and emigration figures exist for this category, but not for the more narrow grouping of “ scientists.’” Unless designated otherwise, the discussion in this paper therefore relates to this broader occupational category, rather than to “ scientists ” more narrowly conceived. The paper briefly attempts what historians term a “ periodisation ” i.e. the identification of long time periods, broken up by major turning points, wherein the underlying factors and trends are reasonably constant. It then examines the recent data - both the overall data, but also focusing on two important occupational subcategories - namely doctors and engineers. Particular consideration is paid to the continental (Africa-wide) dimensions of this migration and the regional dimensions (the SADCC countries) and the case of the key SADCC country, in this respect, Zimbabwe.

The third part of the paper explores some of the policy dimensions. It outlines current government policies as well as the analysis and proposals advanced by the very recent report of the Labour Market Commission in regard to this question. It reports briefly on a brief attempt at a “ brain-gain ” project and advances, very tentatively, some proposals in that regard.

20- Labour migration of highly qualified Colombians: The experience of the Caldas network

Carlos Germán Murcia, Luz Stella Parrado

Most current studies about the labor market international flows focus on the observation of their effects on economic growth in the destination countries. These studies assume a competitive model with perfect neoclassical markets. Nonetheless, the complexity of the market has undermined the principles of work homogeneity, salary as the only adjustment variable between supply and demand and the symmetry of the markets. These " structural defects " of the dominant model become more evident when the theory of this phenomenon, over the long term, with an infinite perspective, is contrasted with empirical studies of short term dynamics. It is also surprising to observe how the dynamics of this market are increasingly regulated by the policy decisions of the state, beyond individual actions. On the other hand, the importance of other, non monetary, motives has been recognized for their ability to affect and catalyse trends in supply and demand for qualified labor in the international context. With these considerations, firstly we propose to describe the limits of the principles that have regulated some economic studies on international labor flows. Secondly, a theoretical overview of social networks will be applied to the study of the international labor market in order to observe the migration phenomenon through the analysis of a sample from the Colombian Network Survey, which corresponds to a study of the Colombian Diaspora.

21- The mobility of human capital from the perspective of Latin American science

Hebe Vessuri

This paper analyzes a set of factors linked to the " demographic balance " of different scientific disciplines in Latin America from the perspective of the movement of scientists in different directions. It takes into account past and present arguments that explain the flows, stressing recent tendencies. In particular, we would like to analyze the argument that states that to the degree that the economies of individual nations become inexorably blended, not only does the flow of capital increase to the point that some begin to feel concern for the Nation-state's ability to protect the interests and welfare of its citizens, but concern as well for the human capital that begins to become equally volatile as its financial counterpart. Globalization, the process of fusing national markets in a planetary version of The Market, brings with it an inevitable displacement, in that human capital follows financial capital to where it is most concentrated. Of course, the mobility of " human capital " is the heart of globalization. But as the implications of this globalizing process begin to change the way we see our own society and its place in the world, it also brings with it revised images of the history and sociology of science, of the creation of national scientific communities in the countries of Latin America and the perception of " brain drain ".

22- Brain drain and new mechanisms of funding in Russian science

Irina Dezhina

The main features of the recent Russian Brain Drain are examined. The Brain Drain process is characterized by three dominant "waves" of emigration of Russian scientists and engineers and it is analized in correlation with the financial situation of Russian Science. New alternatives to preserve the leading directions of Russian research are explained.

23- Emigration: effects on the structuring of the Algerian scientific field

Hocine Khelfaoui

After a brief presentation of the national and international contexts of emigration, this project will try to evaluate its impact on the structure of the scientific field in Algeria. The paper is divided into

two parts. The first deals with the effect of emigration on the two principal institutions that use knowledge : the university and the industrial sector. Paradoxically, the emigration of scientists intensified at a moment in which both sectors, having completed their primary stage of elaboration, began to express the need for Research and Development.

The second part addresses the impact on local scientific activity. The analysis concentrates on the effect of migratory movement - departure and return- on the process of scientific and technical accumulation. Two aspects are evoked : the interaction between a plurality of national scientific logics (confrontation of schools of thought) and the resulting dependence-autonomy situations.

24- Migration of scientists and reinsertion strategies

Pablo Kreimer

We will organize this presentation in two parts. In the first place, we will refer to the different characteristics generally present in scientific migrations (including return to the country of origin) and which will give us some elements to understand the situation of Latin America. In the second part we will describe some lines for the understanding of what we have denominated strategies of reinsertion of scientists returning to the country of origin.

25- The experience of the Pedeciba as a point of inflection on the scientific migrations of the “Basic Sciences” Uruguayan community

Adriana Barreiro Díaz, Léa Velho

The so called ‘Programa de Desarrollo de las Ciencias Básicas-PEDECIBA’Basic Science Development Program emerged in Uruguay by the end of the eighties in order to make possible the rearticulation of the local basic scientists’academic community. The whole system of science and technology was highly affected by thirteen years of military dictatorship. One of the main objectives of the basic science community, during the redemocratization process, was to create the conditions for the consolidation of a permanent infrastructure for the development of basic sciences - namely : Biology, Chemistry, Information and Computer Science, Mathematics and Physics.

One of the basic conditions in order to attain that goal was the repatriation of a great number of the Uruguayan scientists that had left the country during the seventies. Moreover, it is important to point out that it were the own scientists that lived abroad who expressed their wishes on returning, and the possibilities to join the peers that had remained in Uruguay to develop a collective and self-managed effort.

In this work we refer to the migration waves registered inside the Latin American scientific community and to those related to the exodus and returns of the Uruguayan basic scientists ; exploring the reasons, motives and assumptions that laid behind those returns. Furthermore, we present some data that let us understand Pedeciba’s significance both in terms of the rearticulation of the knowledge generation system and in the reconstruction of the basic sciences’environment.

26- Models of scholar migration from China

Paul Robins, Shaoni Tang

This paper describes an investigation designed to identify ways of improving the return rate of Chinese scholars studying abroad. The main focus of the study was the scholars who were sponsored by the Chinese government and Chinese universities. During the past 18 years China introduced reforms that opened its doors to the out-

side world and has sent 250,000 scholars abroad for further study or training, of which 120,000 were sponsored by the government or by their universities. The majority of them went to America and Canada with significant numbers going to Japan, Europe and Australasia. However barely 35 % have returned. This poor return rate worries the Chinese government as it reduces the contribution of the foreign study programme to the modernisation of the Chinese economy.

The study reported here was undertaken to find ways in which sponsoring bodies could manage the scholarships more effectively (in terms of the promptness of return). The study made an analysis of past behaviour of scholars with a view to examining the possibility of improving the return rate by making a better initial selection of scholars. A questionnaire was used to assess the motivating factors of scholars while abroad to help identify further opportunities for influencing the return rate.

The analysis shows that predictions can be made and might be used to improve the value to China of its scholars'foreign study programme. It suggests possible approaches for both the short and long term.

27- Reverse brain drain in Hong Kong?

Wenhui Zhong

The hand over of Hong Kong's sovereignty from UK to China in July 1997 is an important factor both for people leaving colony and for those who are returning. This paper examines the reasons for returning and the psychological forces that have pushed a mobile class of professionals to come to work in Hong Kong. A picture of this group of cosmopolitan middle class is beginning to emerge.

28- Running head: back-and-forth perspective " Back-and-Forth " as a viable alternative to the brain drain perspective, with Chinese examples

Paul Pedersen, Ko Shan Lee

The paper discusses patterns of decision-making regarding the decision to return home after study abroad based on qualitative and quantitative data from science and engineering students from Taiwan studying in the U.S. These data were collected through research. The literature on reentry will be reviewed, critical incident case examples will be presented and suggestions for continued study of reentry issues will be generated.

29- Reversal of Korean brain drain : 1960s - 1980s

Hahzoong Song

This paper examines Korea's experience from brain-drain to reverse brain-drain over three decades, and government policies to cope with this phenomenon.

The study confirms the major role of economic factors in return-or-stay decisions of Korean scientists and engineers who earned PhDs in the U.S.A. When the difference in economic conditions between alternatives is narrowed, however, psychological and emotional factors are identified to be important. In particular, the study suggests that some Confucian values work as an underlying element of KSEs' decisions. Consequently, the study indicates the importance of including a cultural analysis in the study of brain drain issues. Korean government tried to repatriate as many scientists and engineers as possible in 1960s and 1970s. The policy measures of that period were, however, effective in a limited sense.

As Korean economy improved in 1980s and many foreign-educated scientists and engineers intended to return to Korea, Korean

government adopted a policy to utilize needed expertise of Koreans abroad, while helping them choose their residences by themselves.

30- Tunisian experts abroad: a greater contribution to national development

Belgacem Henchi

Since its independence in 1956, Tunisia has been promoting education, which has been obligatory since 1990. Still, the university infrastructure has not developed at the same rate as that of the primary and secondary schools ; especially in the field of important technologies. For a long time, this situation has led the state to send the most intelligent students abroad (Europe, the United States) both for university education and for graduate studies (diplomas, theses, apprenticeships...).

Many of the graduates who were sent have stayed in the destination countries, for many reasons. Their number is quite high, they remain principally in France, Canada and the U.S. Parallel to this, a certain number of internationally renown Tunisian scientists have been attracted by tempting offers to Europe, North America (U.S. and Canada) and the universities of the Gulf countries. Aware of this talent drain, since the 1987 changes, Tunisia has taken a series of measures whose object is to limit a new brain drain, to repatriate Tunisians when this is possible, and to foster scientific collaboration with those who wish to remain in their adopted countries.

31- Emigration of scientists: the Uruguayan case

Adela Pellegrino, Wanda Cabella

The notice of this meeting offers an interesting challenge to take a look at emigration in highly qualified sectors, in this particular case, of scientists. Furthermore, the organizers propose the need to restate the conceptualism of this discussion in the light of changes taking place in the modern world.

In this paper I shall refer to two aspects of the question :

First, status of the discussion on this subject in migration literature. Secondly, I shall situate the Uruguayan case in this context, although research in this subject is very backward in the country.

32- Scientific migrations, cooperation and development networks in Latin America and the Caribbean

Guillermo Cardoza, Raimundo Villegas

Latin American countries are engaged in the restructuring of their economies aiming at overcoming the crisis that have kept them in economic and social stagnation since the early 80’s. The ongoing processes of deregulation and opening of the markets raise the need of designing and implementing technological policies directed at the creation and consolidation of a capacity of innovation able to support the increase in productivity and competitive position required to participate in the most dynamic trends of international trade. To succeed in this complex task, besides the establishment of well-defined policies and the allocation of financial resources, it is necessary to have highly qualified human resources at one’s disposal. However, the significant efforts in qualifying human resources in the region are presently being seriously threatened by the increase of migratory flows of scientists, engineers and professional towards industrialized countries.

Up to some years ago, the analyses of highly qualified personal migration from developing countries to developed countries were centered in determining the causes and motivations of this migration (a phenomenon known as brain drain) and designing repatriation policies to counteract it. These studies attempted to diagnose and quantify the migratory flows and their economic and social

impact. Nowadays, though this is the prevailing approach of the analyses, the development of new telecommunication technologies, particularly in telematic networks, permits to set out the question from a different point of view. In fact, the emphasis is now put on the possibility of making emigration a “ brain gain ” through the cooperation that the emigrated talents can furnish.

The present paper underlines the possibilities of cooperation offered by emigrants participation and endeavors to supply elements to answer the following questions : How can developing countries receive support from their scientists, engineers and other professionals having emigrated to developed countries ? What elements must be taken into account in designing and applying State policies and corporate strategies to associate emigrants. What institutional structures can guarantee the optimal use of cooperation provided by the emigrated human resources, and what role must the governments play in the designing of such structures?

In order to achieve these goals, in this paper we shall proceed by stages. In the first section, we shall study the migrations phenomenon in the context of processes of “ excluding globalization ”, characteristic of the ongoing transformations of the world economy. Moreover, we shall synthesize rapidly the main aspects being considered in different works on migrations. Next, in the second section, after briefly analyzing the impact of these migrations on regional development, we shall study the convenience of moving forward in the construction of the Latin American and Caribbean Global Scientific Community through the creation of Global Networks of Cooperation for Innovation. These networks are meant to incorporate qualified human resources living in and out of the region to a new strategy of regional development. We shall evaluate their utility as a mechanism of knowledge transfer in the process of “ learning to innovate ”. In the third section, we shall undertake the network analysis pointing out its characteristics and advantages, its structure and morphology, as well as the role played by the State in fostering and taking advantage of it for the benefit of development

Finally, we shall briefly present the project “ Database of Latin American and Caribbean researchers and professionals living out of the region ” (Base de datos de investigadores y profesionales de America Latino y el Caribe residentes en el exterior) done jointly by the Latin American Academy of Sciences (Academia de Ciencias de America Latina, ACAL), the Latin American Association of Scientists (Asociation I. atino-americaine de Scientifiques. ALAS) and UNESCO. Likewise, we propose the creation of a Regional Fund for Scientific Cooperation aiming at fostering co-operation among researchers living in the countries of the region and among these with their colleagues emigrated to developed countries.

33- "In contact with Venezuela". Conicit: Design management and assessment of policies

Ivan de la Vega

The National Council for Scientific and Technological Research (CONICIT) is advancing a project called In Contact With Venezuela, whose object is to link Venezuelan professionals located in the exterior with different actors in the National Innovation System, utilizing the communication platform of the National Research Centers and Universities Academic Network (REACCIUN). Parallel to this is a strategy for preventing the emigration of students and professionals in training. Finally, there is the strategy for return, through close monitoring of opportunities and conditions, both of the country and the person. This strategy is intimately linked to information about Venezuelan scientific and technological potential.

34- The dialectics of the virtual and the real In the Caldas network of Colombian researchers abroad

Bernard Schlemmer, Jacques Gaillard, Dora Bernal, Nora Narvaez

The Caldas Network is known as an electronic network assembling, thanks to internet, emigrated Colombian researchers. The idea arising from the network existence is to create or recreate a national scientific community, despite its great geographic dispersion. But it is evident that this community can only exist if its members 'play the game', that is if they feel members of their country of origin's national community as much as they feel members of the international scientific community, and if they know how to act accordingly.

However, for those who have left Colombia a long time ago, as it is the case for some, an identification with the issues at stake related to national development does not come immediately and automatically. A significant effort of motivation is required to involve this unstable population in a collective work.

Presently, the network is composed of 21 'nodes', or local associations of Colombian intellectuals and colombianists in the various countries of residence, existing as a legal entity, or in the way of getting this legal status. Each local 'node'possesses its particular characteristics, linked to the history of its establishment, to the population of its diaspora, etc. The Swiss 'node', for instance, is one of the most dynamic as far as creating international scientific projects is concern, putting Colombian researchers working in Swiss laboratories in relation with Colombian researchers remaining in the country, and with foreign researchers, both Swiss and from other countries. This 'node'is, however, too much focused on 'hard'sciences : human sciences are hardly present in it, and at even less extent are present those who, despite their interest for scientific research, do not practice research as a profession. Conversely, the New York 'node'has a great proportion of Colombians who, instead of being researchers, are artists, writers, members of liberal professions ; this 'node'develops not only scientific exchanges but also all kinds of social and cultural activities (mutual aid, etc.).

The French 'node'seems to be somewhere between these two extremes : it has an important representation of social sciences researchers, but, on the other hand, suffers from undeniable frictions with the exact sciences researchers who have the impression that with that way of functioning the 'node'loses its identity, its specificity and, considering the results they were expecting for themselves, loses also its interest. The deception of the latter has come to such point that some of them have abandoned the association. Some 'nodes'show a concentration in a particular field, such as medical sciences in the case of the Swedish 'node', at Stockholm, whose members, in their majority, are active within the prestigious Karolinska institute.

Such diversity of the 'nodes'is undoubtedly a sign of vigour, but shows, too, the internal contradiction of the project : the model is based at the same time on the assumption of a universal science thus, Colombian scientists must remain in the Northern laboratories - and on the researchers'patriotism : hence, they should feel as Colombians, work actively so as to make the network function. The more they consider themselves scientists, the more they would like to make the Caldas Network an international scientific network, giving priority to the exchange with their peers, not worrying much about benefits for colleagues somewhat strange to their field of activity, seeking support with the excuse of being Colombians ; from this point of view, science has no frontiers. Inversely, the more they feel Colombians, the more they would give in to the temptation of transforming the network into a network of exchange and mutual aid, undermining its strictly scientific potential and losing their colleagues from the first group above mentioned.

In this manner, there is undoubtedly a gap between the network model predominant in the official position about Caldas - that is, the

position where the network is built exclusively in the electronic network and the model which is actually practised by most of its members, even those that consider themselves as active members. In the theoretical model, thanks to the electronic network, the world of science has become a village, distance has been abolished and everyone can dialogue with everyone as if they were all neighbours. In real terms, the world is perhaps a village, but it must be admitted that few meet at the great square, the forum : the dialogue is often limited to the family house, whose windows are probably half open but whose door is closed. Moreover, those who have recourse to electronic mail, use it more often rather to maintain contacts with Colombia than to open dialogue with researchers from other countries : the communications structure of Colombian emigrated researchers members of the Caldas Network does not look like a cobweb with multiple connections ; it rather resembles a star having Colombia as the centre.

We shall develop this remarks in reference to the studied 'nodes'in Austria, Belgium, United States of America, France, Mexico, Sweden and Switzerland.

35- Potentialities and limitations of the Caldas network of Colombian researchers abroad: case studies of joint international projects

José Granés, Alvaro Morales, Jean-Baptiste Meyer

" The Caldas Network " of Colombian researchers and engineers abroad constitutes an innovative proposal in scientific policy, designed with the explicit purpose of relating emigrated scientists to the development of science in the country. Through the network, different modalities of connection and co-operation have been put into practice. Among them we can enumerate the following : assessment of research projects designed in Colombia, exchange of information and services, assistantships during short periods of time, participation in seminars and events of other types, consulting services and finally, design and development of joint research projects. The latter is doubtless the modality of co-operation that, in the long term, may have the greatest impact on the science development in Colombia. In fact, the implementation of joint projects at international level may come to constitute for the country a significant transfer of scientific culture, as well as a construction of stable ties with scientific and technological centres at international level.

Within the Caldas Network several attempts of undertaking joint projects have been set up, with variant success. The study of some of these initiatives may throw some light on the network potentialities, as well as on its limitations. It may also help to clarify the ways of operating and the mechanisms that may be put into practice to motivate and persuade different actors, to negotiate with them and to start off this type of projects.

In this presentation, we shall study two attempts on undertaking joint projects through the network : a multilateral project, named " project BIO-2.000 ", that involves researchers of different countries in Europe and Latin America and a project on transfer of technology in the area of robotics, whose first stage has already been finished. In both cases we will try to elucidate the role played by the still tenuous tissue of relations, in process of consolidation through the Caldas Network.

36- From migration to creativity in the Caldas network: Psychoanalytical approximations

Beatriz Mirámon Archila

Migration can be considered a " traumatic situation ", with all its respective psycho-pathological alterations. This traumatic quality

comes from the sudden suspension of habitary actions in the external world. In the internal world of the migrant, one can point to the loss of identity, since in the majority of cases, individual, family and community particularities which are constitutive in themselves, are cut off. In these cases, creativity is the result of the way the subject manages to transform situations of confusion, chaos and mental suffering into inspiration for growth. This constitutes a paradox, given that the situation of conflict may fortuitously transform into a counterpoint for the development of creativity, as a stimulating element. In psychoanalytical terms, this is the possibility of setting up a duel that permits the subject to achieve a new psychic order.

Given the difficulties of the migration process and the possible creative stimulus of reconstructing a new identity in the exterior, this study could complement the studies of migration, and even preventing or assisting with serious and deteriorating situations, when the psychic resolution is negative and disjointed. It would be interesting to discuss the ideas in this work in the light of the objectives of the Caldas Network, going deeper into the subject as it advances or enriches their process.

37- Information technology as a search mechanism for brain gain

Greta Pifat, Virginia Cano

The present paper explores the use of information technology in the development and maintenance of a database of migrated scientists. Specifically the paper addresses the use of Internet related services such as discussion lists to identify and contact scientists who migrated from developing countries into the industrialized North, and who wish to maintain and renew contacts with their countries of origin. The paper explores methodological aspects of the Internet in the search for scientists and highlights the use of e-mail technologies to retrieve and maintain an up-to-date machine readable database of scientists.

The paper presents the case of Croatia as a case-history of the conditions that lead to the migration of scientists, details the efforts of diverse individuals in sustaining the contact with migrated communities and highlights the way in which such database could be put to use for the benefit of migrated scientists, science policy makers, scientists and young scientists in that country.

38- Globalization of the national scientific community through electronic list: lessons and prospects from a case study in Colombia

Jean-Baptiste Meyer, José Granés

Colombia (South America) is the first country that has fully implemented the “ diaspora option ”, systematically linking its scientists and engineers expatriated all over the World, to their peers in the country, through the so-called “ Caldas Network ”. A major communication device of this network is an electronic list to which most of the participants are connected. Since the beginning, the list serves as both a constitutive space as well as a collective instrument of animation for the national-global community in its construction process.

Our paper will present results of a four years study on the “ Caldas Network ” and on three years of life of its electronic communication, from January 1993 to December 1995. We plan to proceed through 3 points :

- the historical co-developments of the network and list,

- a statistical analysis of 1027 messages exchanged during the 3 years (processed through a database),

- an evaluation of the effective impact that electronic communication has on the extension of the national scientific community beyondthe country’s borders.

The empirical results brought by the study are abundant. Sometimes it confirms some assumptions made on new social trends generated

by INTERNET. But it also contradicts others. What is important is that the evidence gathered allows to assess substantial considerations on the INTERNET phenomenon in S & T.

39- Perspectives of statistical analysis in the study of scientific and professional migrations

Alvaro Montenegro

We shall deal with strategies, techniques and tools used in the survey “ Colombia Networks ” (“ Redes Colombia ”), undertaken as part of the project “ The Brain Drain Revisited through the Colombian Case. A study of ‘The Caldas Network ” (“ El Brain Drain revisited a través del claso Colombiano. Estudio de la Red Caldas ”). The survey was designed with the purpose of studying individuals of the diaspora of Colombian researchers working abroad, in relation to the process of “ brain gain ” which has been going on in Colombia since 1994.

We shall discuss different methodological aspects that must be taken into account when undertaking a survey of this kind, such as : definition of the range of topics, definition of the prior to the study variables, types of data that must be gathered, drafting of the survey form, tracing of individuals, ways of mailing and receiving the survey forms, organisation of the information, preparation of data for the descriptive and specialised statistical analysis, validity of the sample, sorts of descriptive and specialised analysis.

We shall explain the use of modern techniques resulting from the data analysis, such as : correspondences analysis, simple harmonious analysis, text data analysis, analysis of related words useful in studying this sort of surveys. These techniques have recourse to information of several types : biographic and sociodemographic, factual and opinion related. This information is gathered through open and closed questions.

Resumenes

3- Políticas y programas de migraciones de recursos humanos calificados

Lelio Mármora

La transnacionalización de la producción con el consecuente crecimiento de las transnacionales, el desarrollo económico de algunos países, los crecientes cambios en la organización de las formas de producción, y las nuevas estructuras de comunicación son elementos que han determinado un incremento en la movilidad de los recursos humanos calificados (RHC).

Dicho incremento, si bien representa cuantitativamente sólo una parte de las migraciones internacionales, tiene una importancia significativa por sus costos y beneficios, tanto a nivel público como privado.

A su vez, la teoría sobre las migraciones ha sido impactada por estos movimientos, muchas veces de corta duración, replanteándose el significado de los mismos, y la pertinencia misma del concepto « migración ». El cuestionamiento y reflexión sobre estos elementos constituyen la base de las diferentes partes de este artículo.

En principio se analizan las implicancias conceptuales de los diferentes términos « fuga de cerebros », « éxodo de competencias », « transferencia de tecnologías » e « intercambio de destrezas » y su relación con los migratorios.

En la segunda parte, se presentan algunas reflexiones con respecto al costo-beneficio de las migraciones de RCH, y su papel como fundamento de las políticas migratorias.

En la tercera parte se desarrollan las diferentes políticas y programas públicos sobre migraciones de RHC, tales como los de retención, apertura, regulación y recuperación de migares calificados.

En la cuarta parte se analiza la evolución de las políticas privadas sobre esta problemática.

4- Las migraciones internacionales de personas altamente calificadas Un itinerario bibliográfico y conceptual

Anne Marie Gaillard, Jacques Gaillard

A partir de diferentes fuentes documentales (entre ellas siete bases de datos y una decena de bibliografías ya constituidas), se ha creado y reunido en una base de datos un corpus bibliográfico de aproximadamente 1.500 referencias de trabajos, escritos entre 1954 y 1995, cuyo tema es estrictamente las migraciones internacionales de personas altamente calificadas.

La ponencia propuesta tratará sobre las características de la producción científica y periodística identificada. La utilización de indicadores bibliométricos clásicos, tales como la cronología de las publicaciones, la identificación de los autores más prolíficos, la ubicación de las principales publicaciones y de las instituciones clave, permitirá cartografiar el interés que se ha dado al tema durante los dos últimos decenios.

Utilizando un enfoque cualitativo, logrado gracias al análisis de otro conjunto de indicadores tales como los países concernidos por los trabajos, la naturaleza de las publicaciones y los temas abordados, se podrán diferenciar los distintos niveles de interés que ha suscitado la cuestión a lo largo del tiempo. Es así como se verá de qué manera la cuestión de las migraciones fue, en un principio, percibida como una pérdida tajante para el país de la emigración, posteriormente sacada de las fronteras nacionales para convertirse en uno de los asuntos teóricos más controvertidos (en términos de « quién pierde y quién gana ») de las conferencias internacionales sobre el tema del desarrollo para, finalmente, en los últimos tiempos, volver a adquirir un carácter positivo en un contexto de mundialización de los intercambios, en el que estas migraciones comienzan a aparecer

como un fenómeno más bien benéfico para el país de la emigración.

Paralelamente a estos debates existe una producción universitaria nada desdeñable. Su poca visibilidad se explica, en parte, por que las problemáticas que la animan se sitúan a menudo fuera de los envites geopolíticos y socioeconómicos, que han sido objeto de los debates internacionales. Esto se ilustra, de manera particular, por los trabajos de los que se tiene referencia en Estados Unidos, en los que, mediante un importante corpus teórico y empírico, se tratan estas migraciones utilizando un procedimiento que privilegia el conocimiento de los migrantes mismos y de los movimientos migratorios. Estos trabajos contribuyen a enriquecer el conocimiento del « hecho social » y es por lo que procuraremos sacar a la luz esta preciosa fuente de referencias.

Además de mostrar estos resultados, esta exposición tiene como objetivo introducir una herramienta : la bibliografía misma, la que representa una base científica sólida para quienquiera que desee profundizar sus conocimientos en el ámbito citado y que constituye uno de los elementos primordiales para ubicar, con exactitud, el punto está en que actualmente se encuentra la cuestión de las migraciones internacionales de las personas altamente calificadas.

5- Drenaje de cerebros : marco histórico y conceptual

Enrique Oteiza

La migración de los científicos en la historia. Para entender la naturaleza específica de este tipo de migración selectiva contemporánea, parte del llamado drenaje de cerebros, (Brain-Drain) y comprender sus diferencias con otros fenómenos migratorios, resulta útil repasar antecedentes históricos pertinentes. En la historia de la Ciencia y la Universidad, de acuerdo a conocidos textos como el de G. Sarton, C.A. Parsons, F.H. Powicke, H. Waddell, y otros, sobresalen dos aspectos importantes en las migraciones de científicos e intelectuales destacados. El primero se refiere a la alta movilidad de estas personas, en relación a otros grupos en sus respectivas sociedades de origen ; el segundo lo constituye el papel que las politicas explícitas de atracción han desempeñado en estos momentos. Cabe destacar sin embargo que a diferencia del actual fenómeno de drenaje de cerebros, que ha permitido a algunos países incorporar inmigrantes altamente calificados en cantidades que se cuentan por cientos de miles en el lapso de los últimos 50 años, los procesos migratorios anteriores de este tipo, involucraron en lapsos similares, como mucho unos pocos cientos de personalidades destacadas del mundo intelectual y científicos de la epoca.

Desarrollo : Es a partir de la Primera Guerra Mundial que países de origen y de destino de los principales flujos migratorios internaciónales comienzan a definir y aplicar políticas tendientes a retener o a atraer personas con determinadas calificaciónes de acuerdo a sus intereses respectivos, incluyendo científicos. Ya a partir de la Segunda Guerra Mundial las políticas migratorias se perfilaron en lo que concierne al personal científico y técnico de alto nivel. Los países de mayor grado de desarrollo relativo, a sea los industrial y científicamente avanzados, ejercen una atracción a través de múltiples mecanismos que les permite formular e implementar políticas migratorias selectivas. Examinaremos tambien en el documento las características de las distintas fases por las que atravesó este sistema de migración selectiva, desde la Segunda Guerra Mundial.

6- Migración de científicos en la historia de la ciencia de sociedades totalitarias

Yakov Rabkin

La transición desde o hacia sistemas totalitarios pueden desencadenar migraciones de científicos. Esta ponencia examina migraciones de científicos desde una perspectiva comparativa, mirando principalmente a tres países europeos que han experimentado regí-

menes totalitarios y que, al mismo tiempo, desarrollaron infraestructuras de investigación y contaba con renombrados científicos a nivel mundial : la Unión Soviética, la Italia de Mussolini y la Alemania de Hitler. Esta investigación está orientada por las siguientes consideraciones preliminares :

Para el propósito de esta investigación, el término « totalitario » se refiere a las sociedades que han experimentado intentos de « control total » en el curso del siglo 20. Este concepto está sujeto a controversias, y con frecuencia es utilizado polémicamente. Sin embargo, trabajos recientes sobre la naturaleza de las variedades de totalitarismo soviéticas y alemanas continúan apelando a este concepto. Por otra parte, ha emergido en toda la Europa Oriental desde 1980, un pronunciado interés académico por el totalitarismo, incluyendo estudios de este fenómeno relacionado con la ciencia. En esta ponencia, el término « ciencia » incluye principalmente, las ciencias naturales, médicas y exactas. El énfasis sobre las ciencias naturales es motivada por el aceptado carácter transnacional del conocimiento científico en esas ciencias y la identificación concomitante con el internacionalismo científico por parte de muchos científicos que trabajan sobre el tema.

La ciencia y el totalitarismo no tiene que ser vistos como víctima y victimario, una dicotomía que sustenta una buena parte de la literatura existente sobre el tema. Ambos aluden a un conflicto y se refuerzan mutuamente. Los roles de la ciencia en el escenario de la política de este siglo merecen ser explorados, particularmente porque la ciencia es con frecuencia despreciada como un bloque de construcción de ideologías totalitarias.

El éxodo de científicos de países totalitarios, y su relación con las comunidades de científicos que dejan atrás es un fenómeno relacionado con el asunto de resistencia vs colaboración. Por otro lado, está relacionado con la controversia que rodea las relaciones internacionales de la ciencia con las sociedades totalitarias. Todos estos regímenes enfatizan el aislamiento y la autarquía, estableciendo explícitamente una diferenciación entre el mundo de la ciencia y la ciencia orientada ideológicamente («física alemana » o « biología marxista ») bajo un determinado régimen. Pero a la ciencia, debido a su importancia estratégica y diplomática para los líderes totalitarios, le fue permitido (y ocasionalmente también animada) a entrar en contactos extranjeros, no obstante si fueron restringidos y manipulados.

7- Migraciones y construcción de la cooperación científica

Jorge Charum

La opción diáspora es una nueva perspectiva de recuperación de las capacidades nacionales emigradas en CyT. A diferencia de la opción brain gain -que, para asegurar la reinserción en el país de origen de los científicos e ingenieros emigrados, integra una comprensión más precisa de la necesidad de contar con estructuras locales de recepción de los científicos e ingenieros emigrados-, la opción diáspora considera que más importante que el retorno físico de quienes han emigrado es la creación de vínculos de cooperación y colaboración entre éstos y la comunidad científica nacional. Estos vínculos permiten generar una red de relaciones orientadas a la creación de una capacidad científica nacional, con la participación y los aportes deslocalizados de los miembros de la diáspora.

La red y sus dinámicas están determinadas por a) la acción de múltiples actores -investigadores, grupos de investigación, programas nacionales de investigación, responsables de las políticas nacionales, institucionales,...-que desde su posición particular y sus intereses participan en la construcción de una red sociotécnica por la que circulan personas, proyectos, problemas, equipos, documentación ; b) la cooperación y colaboración de actores de la investigación ubicados dentro y fuera de las fronteras nacionales apoyadas en las estructuras investigativas en las que ellos se insertan ; c) la movilización de las acumulaciones y las experiencias logradas por los científicos emigrados que permiten concebir, emprender y

sostener proyectos conjuntos con los miembros de la comunidad científica nacional interior.

La red Caldas es un ejemplo de esta nueva perspectiva en el campo de la CyT. Con base en las publicaciones de los miembros emigrados de esta red y la ubicación de sus actuales actividades de investigación y de trabajo es posible establecer las acumulaciones y las potencialidades de cooperación en áreas especiíficas. La realización de entrevistas permitió caracterizar diferentes tipos de actores y de modos de participación en la construcción de la red y en la generación de sus dinámicas. La orientación de políticas nacionales e institucionales y las decisiones estratégicas en el campo de la investigación puede alimentarse del conocimiento actualizado de estos elementos.

8- Redes collegiales e integración de inmigrantes científicos rusos en Israël

Nina Toren

Se hace el análisis y la comparación de dos tipos de redes de científicos rusos que han emigrado recientemente a Israel.

El primer tipo está compuesto por otros científicos, nombrados por los mismos científicos objeto de la investigación, como los que han influenciado intelectualmente su investigación.

El segundo tipo de red incluye a otros científicos que han ayudado en aspectos profesionales, como el uso de nuevas técnicas de investigación y conectado a los recién llegados con científicos e instituciones del medio.

Estas redes difieren en estructura y contenido, sin embargo, ambas son importantes para una sostenida productividad investigativa y para la integración de emigrantes científicos a una nueva comunidad científica y a un nuevo sistema de investigación.

9- Fuga y gananza de cerebros y comunidades cientificas : la experiencia de la India en el campos de las biotecnologias

Venni V. Krishna

Desde que países en vía de desarrollo como India, se lanzaron a la construcción de una moderna infraestructura institucional de C & T, los problemas asociados con el proceso *de brain drain* han constituido un obstáculo en la creación de capacidades de C & T para el desarrollo a nivel local-nacional en muchos de los campos de emergentes de investigación. La experiencia india, muestra que la capacitación de personal competente en C & T, sin la existencia de un cierto número viable de grupos de investigación o comunidades de especialistas, en el sentido sociológico del término, da lugar, en primera instancia, a la migración de los científicos capacitados a lugares donde ofrecen un mejor clima profesional y tienen una demanda por las capacidades intelectuales. Como corolario de esta situación, la posición de las comunidades de científicos y la profesionalización de los campos de la investigación científica y tecnológica está estrechamente asociado con los fenómenos del *brain drain* y *del brain*, dos figuras que son las caras de misma « moneda ». La promoción y el crecimiento de una comunidad científica profesional o grupos de especialistas en un área de la ciencia no sólo frena el proceso *brain drain* sino que también proporciona un clima profesional y un contexto intelectual que genera el potencial para atraer el retorno de los científicos. Estos hallazgos surgen de un estudio empírico preliminar realizado con algunos grupos seleccionados en las instituciones científicas con mayor liderazgo. El estudio de casos de grupos de investigación en biología molecular, biotecnología y telecomunicaciones revelan además que existen diferentes maneras de profesionalización asociados con los campos de investigación en C & T orientados hacia la « ciencia » y los campos orientados hacia la « industria », con profundas implicaciones para la comprensión de los fenómenos de *brain drain* y *brain gain*.

Para un campo orientado hacia la ciencia como la biología molecular, existen elementos cruciales que actúan como indicadores de este modo de profesionalización : surgimiento de un cierto número de grupos competentes de especialistas, cursos universitarios relevantes a nivel de doctorados, sociedades profesionales y canales de comunicación (es decir, publicaciones periódicas) dentro del país, interacción de los científicos locales con investigadores internacionales, e interacción con grupos internacionales a través de estudiantes y comunicaciones y reconocimiento y legitimidad ante los canales de financiación nacionales. Las publicaciones científicas especializadas y las investigaciones relevantes de vanguardia en el campo son elementos importantes en los campo orientados hacia la ciencia como el de la biología molecular. Por otro lado, en un campo orientado hacia la industria como es el caso de los grupos de investigación en telecomunicaciones, el modo de profesionalización implica la diseminación de actividades : la creación de una demanda por investigación en la industria, la integración de personal capacitado, las patentes en el propio campo de investigación, la importancia de los diseños, los procesos, los instrumentos y planos, etc. — son diferentes elementos que muestran este modo de profesionalización.

La ponencia hace un mapa de tres campos de C & T en el contexto indio en la última década y relaciona la comprensión de la profesionalización con los fenómenos de *brain drain* y *brain gain*. Al hacerlo, en la ponencia se busca sugerir algunas implicaciones políticas relevantes para los países en desarrollo.

10- « Brain gain » en la comunidad científica mexicana : una mirada alternativa

Nora Narvaez-Berthelemot, Angélica María Rosas

La migración de científicos de países en desarrollo hacia otros más desarrollados, ha sido objeto de varios estudios. Incluso se considera como uno de los indicadores del nivel de progreso de una comunidad científica nacional, y representa su capacidad de adaptación, su nivel de creatividad y su necesidad de obtener en el extranjero los medios adecuados para desempeñar su trabajo. Sin embargo, se debe admitir también que un país como México, por ejemplo, ha abierto sus puertas a investigadores extranjeros permanentes, los cuales no sustituyen a los nacionales emigrados, pero toman parte activa en la consolidación de dicha comunidad.

La migración de científicos de países de diferente nivel de desarrollo científico hacia un país determinado, se presenta como una alternativa para la consolidación del potencial científico del país receptor. En el presente estudio, nos proponemos analizar este aspecto, tomando como base los datos del Sistema Nacional de Investigadores de México (SNI). Analizamos la participación de estos científicos extranjeros dentro del SNI, su producción, desempeño y aporte dentro del área de su especialidad.

11- Implicaciones de la mobilidad científica entre Francia y los Estados Unidos

Timothy Carlson, Dominique Martin-Rovet

Cada año cinco mil jóvenes científicos franceses atraviesan el Atlántico con el fin de proseguir estudios de posgrado y doctorado, en los Estados Unidos, o también para efectuar estudios posdoctorales. En cambio, prácticamente ningún norteamericano busca ir a Francia para obtener un diploma de nivel superior y no se cuenta sino con aproximadamente una centena que viene a ocupar un puesto en la investigación posdoctoral. Dicha cifra podría ser aproximadamente el doble si se tienen en cuenta los científicos norteamericanos que, a la mitad del recorrido de su carrera, vienen a trabajar por un corto período de tiempo en un laboratorio francés. A esta situación que atraviesa el campo científico se opone la del mundo de las letras : es, en efecto, por oleadas (alrededor de 3000) que los estudiantes norteamericanos del primer nivel básico universitario

(licenciatura) llegan a Francia con el fin de realizar estudios en el campo de las letras, dichos estudios durarán un año o más. A este cuadro un poco preocupante hay que agregar otro elemento desconcertante ; mientras que Estados Unidos tiene la reputación de acoger a los estudiantes extranjeros con los brazos abiertos, es, en realidad Francia la que recibe, relativamente, más : dentro de la población estudiantil vemos que en Francia los estudiantes extranjeros son tres veces más que en los Estados Unidos. Y no podríamos decir simplemente, incluso si existe una parte de verdad, que los científicos norteamericanos son alérgicos a los idiomas extranjeros. No podemos dejar de observar que, su movilidad internacional teniendo en cuenta a todas las permanencias en el extranjero (incluyendo aquellas que se han efectuado en los países angloparlantes), es muy pobre con relación a la de los países Europeos. A través de las encuestas publicadas anteriormente (*cf. Bibliographie*) aparece la importancia que tiene para los investigadores la noción de libertad. Por lo tanto, ésto nos ha llevado a explicar los problemas ante los cuales se debaten la mayoría de los científicos, con el fin de mantener su independencia, a utilizar la profesión científica como marco de reflexión, a conocer el suministro, por parte de un especialista, de los servicios a cambio de la remuneración y de privilegios. Una investigación libre es, en muchos aspectos, menos libre cuando se convierte en la retribución de un servicio profesional. Es interesante anotar que siempre se ha entendido el mismo leitmotiv : el cruzar el Atlántico le ha dado al científico, de una u otra manera, una libertad más grande en sus trabajos de investigación en los Estados Unidos y, en Francia, un cierto número de estadounidenses ha experimentado el mismo sentimiento.

A los conceptos de profesionalización de la ciencia, de carrera, de independencia ; a menudo opuestos y siempre sometidos a la presión política que les impone el entorno social, hay que agregar las percepciones variadas de « centro y periferia » de la ciencia. Nada es verdaderamente simple y la causalidad directa no contribuye al análisis. Es ésto lo que trataremos de despejar en este trabajo.

12. Patrones de colaboración de científicos en la Universidad Nacional de Mexico

Jane Russell, Margarita Almada

La integración de los científicos de los países de la periferia, especialmente de los del mundo en desarrollo, dentro de la comunidad científica global, se considera como un importante requisito para el mejoramiento del desempeño nacional de la investigación. Se acepta que el establecimiento de contactos con colegas de países con un alto perfil de investigación compensa en algún grado el aislamiento y las limitaciones de las emergentes comunidades científicas del Tercer Mundo. En esta ponencia se ve la importancia relativa, en términos del desempeño de la investigación, de los vínculos establecidos con colegas nacionales e internacionales (expresada en las coautorías y citaciones) de 15 de los más productivos investigadores que trabajan en la Universidad Nacional de México (UNAM) en 5 áreas diferentes : Biomedicina, Química, Física, Astronomía, y Ciencias de la Tierra. Los primeros resultados destacan la colaboración internacional como un elemento importante en el desarrollo de las carreras científicas de todos los 15 científicos. Se está analizando la trayectoria de estos científicos con el fin de determinar los efectos de las coautorías en patrones de publicación de los científicos de la UNAM y los papeles relativos de los mexicanos y los pares extranjeros en este contexto.

13- Emigración de científicos argentinos : el Caso Conicet

Celina A. Lértora Mendoza

El trabajo tiene la finalidad de presentar un cuadro del proceso de « fuga de cerebros » de esta institución, creada en 1958 sobre el modelo del Consejo Francés, y que se propuso crear un grupo nacional de excelencia científica.

A lo largo de su gestión, el Conicet ha visto parcialmente malogrados los esfuerzos e inversiones en formación de alta calificación

debido a procesos emigratorios. En un intento de dar una explotación preliminar global, se intenta :

1. Trazar un cuadro estadístico del flujo, en la medida en que se conservan los datos (los archivos de la institución no son completos).
2. Determinar las causas de los alejamientos, que provisoria y descriptivamente estimo como :
a. Debidas a factores ajenos presionantes (políticos y económicos)
b. Debidas a dificultades del sistema científico mismo para mantener a sus investigadores en condiciones satisfactorias
c. Ofertas alternativas y cambios de mentalidad.

A causa de la gravedad del proceso de emigración habido en los años 1973-1977, en 1984-1986 se implemento por primera vez en forma sistemática una política de repatriación cuyos resultados reciben interpretaciones disímiles. No existen datos exhaustivos, pero los que se poseen demuestran que la respuesta fue mas bien escasa e incluso un buen porcentaje de los que regresaron no lograron una ubicación local adecuada y emigraron nuevamente.

Frente a esta realidad se puede explorar en el futuro próximo los resultados de una solución alternativa que comenzó a implementar Conicet en los últimos años y que consiste en establecer un flujo organizado de intercambio intelectual entre los investigadores argentinos residentes en el país y los que trabajan en el exterior. En la ponencia se analizan las dos condiciones básicas que deben cumplirse : a) suficiente homogeneidad entre las dos comunidades y b) expansión social de ese interés investigativo especifico.

14- La emigración de científicos en Chile, 1973-1990

Manuel Jiménez

Las razones de la migración de científicos durante este período en Chile se han relacionado con tres factores principales : en primer lugar, los bajos salarios de los científicos, sobre todo en las universidades, que son las instituciones que congregan a la mayoría de los científicos en Chile ; en segundo lugar, la escasez de equipos avanzados para trabajar en determinados ámbitos ; y, finalmente, razones políticas originadas en la existencia del gobierno militar.

Tradicionalmente, los gobiernos y las universidades han intentado mantener bajo control la migración de científicos a través de :

a) regulaciones legales y cláusulas en los contratos de trabajo ;

b) ampliación de las instalaciones y mejora de los equipos científicos en determinados ámbitos ;

c) robustecimiento de los contactos entre los científicos chilenos y sus pares alrededor del mundo ;

d) una alta evaluación de la investigación con respecto a la carrera académica ; y

e) la creación de un fondo para financiar la investigación científica en el que una considerable suma se dedica a incrementar los salarios de los científicos.

Durante este período, el Gobierno ha desarrollado una amplia gama de instrumentos a fin de mantener bajo control la migración de científicos, logrando cierto éxito en la disminución de este problema. Además, se ha llegado a acuerdos entre fundaciones privadas y el Gobierno a fin de expedir algunas regulaciones que inciten a los beneficiarios de dichas instituciones a volver al país tras su formación de posgrado.

La altamente restringida capacidad de las Universidades para ofrecer empleo, especialmente a los jóvenes científicos en el ámbito de las ciencias puras es la principal razón para la migración de este personal altamente calificado. El otro empleador potencial de los científicos, la industria, carece de cultura investigativa, tanto en el campo de las ciencias aplicadas como en el de las ciencias puras.

Así pues, cuando las industrias necesitan asistencia, realizan contratos de investigación con las universidades.

La evolución del empleo en el campo de las ciencias sociales, así como el papel desempeñado por las fundaciones extranjeras en la investigación social resultan extremamente interesantes. En el período estudiado, el patrocinio para las ciencias sociales aumentó hasta niveles desconocidos en Chile, proporcionando numerosos puestos de trabajo y contribuyendo a disminuir la migración en esta área.

Gracias a mecanismos administrativos y jurídicos destinados a evitar la migración de los científicos, se ha logrado que un grupo, compuesto especialmente por jóvenes y promisorios investigadores, permanezca en el país. Estos investigadores están libres de ataduras con el Gobierno o con universidades. La mayoría de ellos han obtenido recientemente títulos de doctorado (*Ph.D.*) mediante sus contactos personales o a través de instituciones nacionales o extranjeras, pero para ello no han firmado cláusulas obligatorias de regreso al país y, por lo tanto, pueden emigrar cuando así lo deseen.

El otro grupo propenso a emigrar está constituido por personas con una buena hoja de vida como científicos. Este grupo posee dos clases de contactos con el extranjero : a) amistad personal con científicos de alto nivel en el extranjero, y b) un buen nivel de contactos con científicos residentes en países en el extranjero con quienes, además, comparten un interés por determinada área de la investigación.

En este trabajo se tratarán dos aspectos principales de la migración de científicos : 1) el estudio del papel y del efecto de las restricciones legales y de los incentivos para evitar la migración de los científicos ; y 2) la cuantificación aproximada del número de científicos de alto nivel y de científicos jóvenes que emigraron en el período estudiado y de las razones que los condujeron a hacerlo.

15- Migración científica en Rusia en el principio de los años 1990s : escala, estructura y consecuencias

Galina Kitova

1. Dinámicas del personal en Investigación y Desarrollo y procedimientos de investigación para estudiar la migración de científicos. Durante muchas décadas, en la antigua URSS y particularmente en Rusia, el número de personas que trabajaban en el área de Investigación y Desarrollo aumentaba constantemente. A fines de la década pasada, esa tasa de crecimiento bajó considerablemente y a comienzos de los años 1990, la disminución fue absoluta. Hasta 1992 los procedimientos para estudiar este proceso prácticamente fueron los mismos. Los análisis se limitaron esencialmente a evaluar el movimiento de personal en I & D a partir de indicadores tradicionales.

Las reformas económicas y políticas en Rusia a comienzos de los años 1990 se llevaron a cabo en un contexto global de crisis económica y social. Esta crisis afectó profundamente el área de I & D y modificó abruptamente los mecanismos tradicionales y las tendencias de desarrollo del personal en I & D. En 1992, mientras que el número total de personas que trabajaban en I & D en Rusia bajó en un 26 %, se hizo evidente la dependencia rígida de la extensión y de la estructura de este indicador (número de personas en I & D) con respecto a los parámetros de movilidad de personal (particularmente los parámetros de egreso de personal del área de I & D). Como consecuencia, los analistas rusos y extranjeros emprendieron investigaciones sobre los procesos propios a la movilidad de personal en I & D en Rusia. Inicialmente, se interesaron en el problema de la migración de científicos rusos hacia el exterior y fue entonces cuando dieron la primera señal de alarma. Sin embargo, esos estudios no reflejaron la extensión ni la importancia reales de dicho problema en Rusia. En efecto, según las estadísticas oficiales rusas, 426 científicos emigraron en 1993 con el propósito de insta-

larse permanentemente en el exterior. Pero la pérdida total de científicos durante ese año fue de 17.000 personas.

2. Dimensión y estructura de la pérdida interna de cerebros

Entre 1992 y 1995, el egreso de personal del área de I & D en Rusia excedió significativamente el ingreso de personal en esta misma área (el triple en 1992 y más del doble en los años siguientes). La distribución de aquellos que abandonaron los varios campos del I & D es variada. El cambio más notable se dio en la reducción del número relativo de investigadores. Esta reducción se explica en parte por la crisis económica que impidió a los investigadores encontrar nuevos empleos que estuvieran de acuerdo con su nivel de educación y sus capacidades.

El hecho de que el éxodo de auxiliares y técnicos en esta área sea superior al de los investigadores puede explicarse por un menor « compromiso » de las dos primeras categorías con la especialidad de I & D (comparativamente al compromiso de los investigadores). Además, sus competencias, experiencia y capacidades les permitieron encontrar empleos mejor remunerados fuera del área de I & D y de adaptarse rápidamente a sus nuevos cargos.

El efecto negativo del éxodo intensivo de estas dos categorías de personal del área de I & D apareció claramente a partir de 1993. Este hecho condujo a la disminución en el número de experimentos en la ciencia rusa, así como a una disminución en su complejidad y calidad. Los técnicos y auxiliares que continuaron sus actividades en esta área perdieron gradualmente sus habilidades. Y necesariamente la calidad y los resultados de la I & D se vieron afectados.

Más de la mitad de los que abandonaron la ciencia entre 1992 y 1995 lo hicieron voluntariamente. Eso significa que la reducción de personal en I & D durante ese período se efectuó espontáneamente y que el gobierno no reguló tal proceso, su extensión ni su estructura. Esta conclusión puede ser corroborada porque durante este período declinó la parte relativa de despidos debidos a cortes de personal. Según la legislación rusa del trabajo, cualquier persona puede abandonar su empleo para ocupar otro. Pero la parte relativa de estas personas en el proceso de deserción fuera del área del I & D disminuyó considerablemente.

16- Migraciones científicas internacionales : 25 años de migraciones de científicos latinoamericanos en Europa (Francia 1970-1995)

Guillermo Lozano

Las migraciones de los científicos latinoamericanos en Europa han generado un potencial científico-tecnológico que es necesario identificar, a través del análisis de un proceso particular, el de la migración en Francia en este caso, con el fin de optimizar la consolidación de las Redes Internacionales. Establecer los orígenes, disciplinas y estrategias de inserción de los científicos e investigadores de América Latina en la comunidad científica francesa, permite afinar -a través de procesos particulares- los instrumentos de análisis en la comprensión de los procesos de migraciones científicas internacionales.

Al establecerse un « perfil », un conjunto de características propias del científico latinoamericano dentro de la comunidad científica francesa y al identificar el tipo de relación con el país de procedencia, se pueden determinar de una manera mas precisa las estrategias de consolidación de las Redes Internacionales de Científicos de América Latina y el Caribe.

Igualmente, al determinar cuales han sido las políticas de financiación en la formación de recursos humanos efectuadas por la Región Latinoamericana y cuales las de Francia a través de sus programas de cooperación durante 1970-1995, se establecen nuevos aportes en el diseño de políticas de financiamiento para las actividades científicas y tecnológicas.

17- « Brain drain » : problema de la migración por contrato en Rusia

Tatyana Kouznetsova

La emigración de científicos (por capacitación, viajes de negocios a largo término, o por contrato de trabajo) es la fórmula principal para el contacto internacional. Refleja la profundización del proceso de la división internacional del trabajo en el área de la Ciencia y la Tecnología. En Rusia, este proceso ha tenido consecuencias particularmente controvertidas.

La emigración de científicos o su salida al extranjero por un contrato de trabajo a largo término todavía no es una modalidad normal de intercambio científico. Esta presenta todas las características de una fuga de cerebros unidireccional, problema que afrontan varios países en vía de desarrollo y los países en transición económica. En este sentido, los discursos que afirman que los científicos rusos enriquecen la ciencia mundial son en parte válidos.

El presente documento expone algunos resultados de una investigación llevada a cabo con dirigentes y miembros del personal de instituciones académicas y centros científicos del Estado. La investigación hace énfasis sobre los científicos que han trabajado en proyectos internacionales en el exterior.

* Según los datos del Comité de Estado de Estadísticas sobre Rusia, durante 1993 más de 65.000 personas emigraron de Rusia, lo que representa 20 % de la población con estudios superiores. Los científicos no constituyen una gran proporción de estos emigrantes -1 % en promedio. Si se incluye en esta categoría de emigrantes a los profesores (de estudios superiores), los ingenieros, los dirigentes de impresas y los estudiantes, entonces la emigración científica rusa excede el 20 %. Esto muestra la gran calidad de los emigrantes rusos.

* La investigación sobre instituciones científicas con potencial considerable de emigración demostró que las autoridades respectivas fueron conservadoras en sus estimaciones con respecto a la extensión de la emigración. A través de los análisis de la importancia de este problema para Rusia (particularmente en lo que concierne el mantenimiento de escuelas científicas) y del daño causado por la emigración de científicos en campos específicos de la investigación, ellos subrayan los siguientes puntos fundamentales :

- la mayoría de casos de emigración se deben a razones personales y familiares, y no a razones profesionales ;

- el ingreso a instituciones de estudiantes universitarios graduados inexperimentados agrava el problema de la continuidad científica ;

- los científicos prefieren la emigración por contrato de trabajo a la emigración directa ;

- nuevas oportunidades de auto-realización están emergiendo en las instituciones científicas rusas ;

- los científicos que trabajan en el exterior aspiran a conservar contactos con las instituciones rusas ;

- los efectos nefastos sobre la ciencia son mucho más importantes cuando se trata de la migración interna y la erosión de la actividad científica causada por el poco apoyo del Estado a la ciencia, la privatización y otros procesos que tienen lugar en la Investigación y Desarrollo en Rusia.

* La obtención de un trabajo al exterior es uno de los objetivos más atrayentes de la actividad profesional : es la aspiración del 63 % de los trabajadores de la Academia Rusa de la Ciencia. En ciertas instituciones, 85 % de los científicos prefieren trabajar en función de becas y contratos. Los trabajadores científicos tienen muchas oportunidades de participar en programas de cooperación internacional.

* Un trabajo al exterior presenta ventajas innegables para los científicos. Las ventajas materiales revistan una gran importancia, pero no son las únicas. La posibilidad de realizar investigaciones con buenos recursos materiales y técnicos y de utilizar informaciones científicas actualizadas, es también muy importante. Otro elemento vital tiene relación con el deseo de mayor independencia y autosuficiencia, y con

el deseo de tener más oportunidades de recibir becas tanto en Rusia como en el exterior. Estas motivaciones pueden convertirse en los principales incentivos para la emigración temporal. Todo esto está ligado a la importancia conferida a la integración a la comunidad científica. El nombre, las referencias, el status de la institución, los proyectos, la reputación, la participación en eventos internacionales, y otros factores, determinan las posibilidades tanto profesionales como materiales, y las oportunidades de promoción a nivel profesional.

* Aproximadamente 80 % de los científicos rusos han publicado los resultados de sus trabajos en el exterior, en revistas extranjeras prestigiosas. En sus publicaciones, la inmensa mayoría han subrayado su pertenencia a instituciones rusas. Trabajar al exterior ha permitido a los científicos estar mejor informados y ampliar sus contactos internacionales. Sin embargo, existen obstáculos bien conocidos : las publicaciones extranjeras son inaccesibles a la mayoría de los científicos rusos, el cambio de personal en la ciencia nacional empobrecen las investigaciones locales, las instituciones no hacen seguimiento de lo que publican sus empleados en el exterior y no llevan a cabo ningún análisis sobre sus publicaciones. La indiferencia de la mayoría de los encuestados en lo que concierne a la protección de los derechos de autor de su producción científica es bastante abrumador.

* Con el propósito de identificar los problemas que enfrentan los científicos rusos en el exterior, este estudio analiza las condiciones en las cuales se establecen los contactos internacionales entre científicos, la naturaleza de los convenios entre une organización y sus trabajadores, las estimaciones de salarios y de condiciones de trabajo, la presencia o ausencia de situaciones conflictivas, las posibilidades de mantener su status, etc. Los problemas más citados fueron : las barreras lingüísticas (34.9 %) ; la necesidad de aprender a utilizar nuevos instrumentos y nuevas técnicas (16 %) ; las diferencias en los métodos científicos (11 %) ; la alienación (11 %) ; las diferencias del contexto cultural (7 %).

* Según la opinión de los encuestados, sería conveniente para las instituciones estatales rusas en el exterior establecer asociaciones profesionales de científicos rusos residentes en el exterior con el fin de desarrollar contactos internacionales. Estas asociaciones serían útiles no sólo para los científicos mismos (afirman 58.6 % de los encuestados) sino también para la ciencia rusa (52.6 %), y podrían motivar a los científicos rusos a regresar a su país. Estas asociaciones podrían ayudar a los científicos rusos a adaptarse mejor a las condiciones de vida y de trabajo en el exterior y asistirlos en la protección de sus derechos.

18- La transferencia inversa de tecnología en Africa sub-sahariana : algunas lecciones de una evaluación preliminaria del caso de Zimbabwe

Bernard Ikubolajeh Logan

La transferencia de tecnología (brain drain) ha resurgido como un problema serio para el desarrollo. Para Africa del Subsahara, esto es un asunto particularmente problemático debido a su bajo nivel de participación en la división internacional del trabajo. Información proveniente de Canadá y Estados Unidos es utilizada para establecer la situación que muestra que la región parece está perdiendo un gran porcentaje de sus expertos cualificados precisamente cuando más los necesitan para alcanzar sus metas de desarrollo. Elementos principales de este problema se discuten en este documento y se recomiendan algunas políticas al respecto

19. Migración de profesionales, semi profesionales y tecnicos en Sur Africa

David E. Kaplan

Los modelos y causas de la migración de científicos hacia y desde Sudáfrica son complejos. Tanto las « atracciones » como las

« repulsiones » de los científicos y de los técnicos para trabajar en Sudáfrica han estado determinadas por una serie de factores políticos y económicos. Estos determinantes, que no han sido constantes a lo largo del tiempo, han estado cambiando y actualmente, al menos en alguna medida, dependen de las opciones políticas.

A manera de introducción, en la primera parte de este trabajo se esbozarán brevemente las capacidades de Sudáfrica con respecto a la ciencia y la tecnología. Frecuentemente se contrastarán estos datos con los de otros países africanos, pues, como lo veremos, las migraciones de científicos entre Sudáfrica y el resto del continente africano ha adquirido una especial importancia.

En la segunda parte de este trabajo, se intenta un primer examen de los datos empíricos sobre migración « científica » hacia y desde Sudáfrica. Una importante aclaración que ha de hacerse desde el comienzo es que los datos a los que se alude aquí se refieren no a la migración de científicos sino más bien a la categoría de ocupaciones profesionales, semiprofesionales y técnicas. Existen cifras sobre emigración e inmigración para esta categoría, pero no para el grupo más restringido de los « científicos » [1]. A menos que se especifique lo contrario, la discusión en este trabajo se refiere, pues, a la categoría ocupacional más amplia, y no a los « científicos », concebidos de manera más restrictiva. En este trabajo se intenta lo que los historiadores denominan una « periodización », es decir la identificación de largos períodos de tiempo, separados por hitos destacados, en los cuales los factores y tendencias subyacentes son razonablemente constantes. Posteriormente se examinan los datos recientes, tanto los de índole global como los que se centran en dos importantes subcategorías ocupacionales, a saber los médicos y los ingenieros. Se presta una atención particular a las dimensiones continentales (a lo ancho de África) de esta migración y a las dimensiones regionales (los países de la Conferencia para la Coordinación del Desarrollo en el África Austral, *South Africa Development Coordination Conference, SADCC*), así como al país clave de la SADDC, a este respecto, Zimbawe.

En la tercera parte de este trabajo se exploran algunas de las dimensiones en cuanto a política. Se destacan las políticas gubernamentales actuales, así como los análisis y propuestas del reciente informe de la Comisión de Mercado Laboral (*Labour Market Commission*) por lo que atañe a esta cuestión. Se da cuenta, brevemente, de un corto intento de llevar a cabo un proyecto de « recuperación de cerebros » y, de manera bastante provisional, se hacen algunas propuestas al respecto.

[1] Las principales subcategorías de esta división son las siguientes : ingenieros y tecnólogos en áreas relacionadas con este campo; médicos generales, médicos especialistas y odontólogos; educadores y profesiones relacionadas con la educación; contadores y profesiones relacionadas con la contaduría; otras.
Los ingenieros están en general incluídos en los estudios de migración «científica», por lo que aislamos y presentamos aquí los datos relacionados con esta subcategoría. Las otras subcategorías incluirían también a la categoría de «científicos» tal como se entiende tradicionalmente, pero sería también más amplia que ella. Los datos para la categoría completa de ocupaciones profesionales, semiprofesionales y técnicas son una medida de la fuga de cerebros global.

20- Migraciones laborales de colombianos altamente calificados : el caso de la Red Caldas.

Carlos Germán Murcia, Luz Stella Parrado

La mayor parte de los estudios actuales acerca del flujo internacional del mercado laboral están orientados a observar los efectos que sobre el crecimiento económico de los paises tiene el trabajo. Estos estudios asumen en su base los supuestos del modelo competitivo de mercados perfectos neoclásicos.
Sin embargo la complejidad de este mercado ha debilitado los principios de homogeneidad del trabajo, el salario como única variable de ajueste entre oferta y demanda y la simetría de los mercados. Estas « fallas anatómicas » del modelo dominante se hacen más evidentes cuando se contrasta la teoría de este fenómeno, en el largo plazo, con

horizonte infinito, y los estudios empíricos con dinámicas de corto plazo. Resulta además sorprendente observar como la dinámica de este mercado viene siendo cada vez más regulada por decisiones de política de los Estados más allá de las decisiones individuales. Por otro lado, se ha venido recfonociendo la importancia de otras motivaciones, no monetarias, que han potenciado y dinamizado las decisiones de oferta y demanda de trabajo calificado en el contexto internacional.

Con estas consideraciones nos proponemos, en primera instancia, describir los límites de los principios que han regulado algunos estudios ecónomicos sobre los flujos internacionales laborales. En segundo lugar se acudirá a una orientación teórica de redes sociales apolicado al estudio del mercado laboral internacional para dar cuenta del fenómeno migratorio a través del análisis de un segmento de la muestra de la Encuesta Redes Colombia que corresponde al estudio de la diáspora colombiana en el exterior.

21- La movilidad científica desde la perspectiva de América Latina

Hebe Vessuri

Este documento analiza un conjunto de interrogantes vinculadas al « balance demográfico » de diferentes disciplinas científicas en América Latina desde la perspectiva de los moviemientos de científicos en diferentes direcciones. Se toman en cuenta argumentos del pasado y del presente para explicar los flujos, con acento en las tendencias recientes. En particular, queremos analizar el argumento que sostiene que a medioda que las economías de las naciones individuales se entremezclan inextricablemente, no sólo se intensifican los flujos de capitales hasta el punto que algunos comienzan a inquietarse respecto a la habilidad del estado-nación de proteger los intereses y el bienestar de sus ciudadanos, sino que también el capital humano comienza a asumir una volatilidad similar.

La globalización, el proceso de fusionar los mercados nacionales en una versión planetaria del Mercado, llevaría consigo ese desplazamiento inevitable en tanto que el capital humano seguiría al capital financiero en aquellas áreas donde éste esté más concentrado. Desde luego, la movlidad del « capital humano » está en el corazón de la globalización. Pero asi como las implicaciones de este proceso globalizador comienzan a cambiar la manera como vemos a nuestras propia sociedad y su lugar en este mundo nuevo, tambien imponen una revisión de la imagen producida por la historia y la sociología de la ciencia de la conformación de las comunidades científicas nacionales en los países de América Latina y de la percepción de la « fuga de talentos ».

22- « Brain drain » y nuevos mecanismos de financiación de la ciencia en Rusia

Irina Dezhina

La ciencia rusa está ahora en crisis. El proceso de la « fuga de cerebros » a nivel interno y externo es uno de sus reflejos. Evaluar el estado real de la ciencia en Rusia, significa mirar la evolución de la financiación de la investigación y el desarrollo (I & D). La fuente de financiación nacional dominante es el apoyo federal. Durante los últimos dos años, aparecieron nuevas formas de financiación federal, las cuales se han desarrollado rápidamente, tales como : Los Centros Federales para la Investigación (CFI) y los Programas Federales de Ciencia y Tecnología (PFCT). Estas estructuras fueron anunciadas por el gobierno ruso entre sus principales prioridades. Como instrumentos de realización de políticas científicas, los PFCT juegan un papel muy importante en el logro de las metas nacionales. Sus costos son altos, y sus fondos aumentan más rápido que el total de los gastos en I & D. Las instituciones y los grupos de investigación que toman parte en la implementación de estos programas tienen mejor posición financiera. Esto influye en

las condiciones socio-económicas del trabajo de investigación y, como resultado, la movilidad del personal que trabaja en investigaciones. Desde este punto de vista existen muchas similitudes entre los PFCT y los CFI.

Los Centros Federales para la Investigación están entre las instituciones nuevas más interesantes, por que aparecen como reacción a la transición en el medio de la ciencia rusa. La idea fue preservar las tendencias y los grupos que lideran la labor investigativa por medio de un apoyo adicional desde el presupuesto federal. Al mismo tiempo, todos los CFI están profundamente involucradas en la implementación de los Programas Federales de Ciencia y Tecnología. Hoy existen 61 de estos centros, cerca de un 1.5 % del número total de organizaciones científicas en Rusia. En 1994, recibieron cerca del 8 % de la inversión federal en el campo de la ciencia.

Durante el mismo período de tiempo, reapareció una fuente de financiación muy influyente, las fundaciones extranjeras donantes. Desde que abrieron sus oficinas en Rusia, un número considerable de estas fundaciones han desarrollado programas especiales para apoyar las ciencias naturales y sociales, y las humanidades. En 1994, el aporte de estas fundaciones en la financiación de investigaciones básicas fue igual en monto al aporte del gobierno para este propósito. Por lo tanto, la selectiva influencia de las fundaciones sobre el comportamiento social de los científicos es considerable.

Un aspecto importante de las políticas de las fundaciones extranjeras es patrocinar la conversión en la investigación sobre las armas y la defensa. Un resultado indirecto de tales programas ha sido la prevención de la fuga de cerebros desde la ciencia de la defensa. Actualmente, una de las iniciativas más exitosas que apuntan a ayudar a la conversión es un programa especial para científicos e ingenieros de armamentos proporcionado por el Centro Internacional para la Ciencia y la Tecnología (ISTC). Los proyectos del ISTC son financiados por los Estados Unidos, la Unión Europea y Japón, como también por Finlandia y Suiza, los cuales confluyeron en el ISTC antes de pertenecer a la Unión Europea. Desde marzo de 1994, el ISTC ha distribuido cerca de 70 millones de dólares en la financiación de proyectos civiles para promover la redirección de la defensa de la investigación. Esto es mayor que los gastos de los programas de investigación a largo plazo para ciencias naturales de la ampliamente promocionada Fundación Internacional de la Ciencia (más conocida popularmente como Fundación Soros). Hoy el ISTC brinda su apoyo a 9.500 investigadores que representan cerca del 14 % de todos los especialistas que han tenido acceso a los secretos especiales. También, han influido las fundaciones extranjeras en la aparición de las fundaciones de ciencias rusas. En 1993, empezó sus operaciones la primera fundación rusa -la Fundación Rusa para la Investigación Básica (RFBR)-, en 1994 fue establecida la Fundación Rusa de Ciencias para las Humanidades. A estas fundaciones se les asigna el 4 % y el 0.5 % del dinero federal destinado para la ciencia, respectivamente. En consecuencia, las fundaciones rusas representan una forma más de distribución del apoyo federal mientras que al mismo tiempo constituyen nuevos mecanismos institucionales y motivacionales y su impacto sobre la movilidad de la comunidad científica es significativa.

En mi proyecto de investigación, el análisis del proceso de la fuga de cerebros se implementa en un contexto comparativo bastante amplio, ya que depende del financiamiento y los cambios institucionales en la ciencia rusa. Se hace énfasis en el análisis de las estrategias de financiamiento a los investigadores como individuos y a las instituciones de D & I ; una aproximación a la influencia de las nuevas fuentes de apoyo en las perspectivas de sobrevivencia de las instituciones, grupos de científicos y académicos. El análisis cubre diferentes tipos de movilidad científica : emigración al extranjero y a otros ramos de la economía al interior del país ; trabajo por contratos en países extranjeros, como también del comparativamente nuevo fenómeno en la ciencia rusa, el llamado « migración informacional », que ocurre cuando los científicos rusos prefieren publicar los resultados de sus investigaciones en revistas extranjeras. La

evaluación del impacto de las fundaciones no-rusas en la movilidad de los científicos recibe especial atención en el proyecto. Esto contribuye a la comprensión de la efectividad de la participación extranjera en la ciencia rusa. Este aspecto es de vital interés tanto para la comunidad rusa como para la comunidad internacional. Más interesante son los efectos indirectos de las actividades de las fundaciones : su influencia sobre el clima social en la comunidad científica, sobre la capacitación y el papel social de las nuevas generaciones de estudiantes, sobre la fuga de cerebros a nivel interno y externo. Yo enfoco atención particular sobre la ciencia de la defensa y los problemas de conversión. Investigadores en el área de la defensa tienen un comportamiento social específico, debido a que la reducción de la fuga de cerebros en este sector es una tarea especial y separada. Analizo detenidamente la experiencia del ISTC.

El propósito final de esta investigación es entender qué estructuras son las más efectivas para detener la fuga de cerebros y cuáles son los mecanismos que mejor regulan este fenómeno. Esta investigación está apenas empezando. Los primeros resultados miden el impacto de las fundaciones extranjeras sobre la movilidad en el campo de la investigación.

23- Emigración : efectos sobre la estructuración del campo científico en Argelia

Khelfaoui Hocine

Después de una breve presentación del contexto nacional e internacional de esta emigración, este proyecto intenta evaluar su impacto sobre la estructuración del campo científico argelino.

La ponencia se divide en dos partes. La primera trata del efecto de la emigración sobre las dos principales instituciones que utilizan el saber, la universidad y la empresa industrial. Paradójicamente, la emigración de científicos se intensifica en el momento en que la universidad y la empresa, después de haber su fase de fundación, comienza a expresar necesidades en Investigación y Desarrollo. La segunda parte, trata del impacto sobre la constitución de una ciencia local. El análisis se concentra sobre el efecto de este movimiento migratorio—salida y retorno—sobre el proceso de acumulación científica y técnica. Se evocan dos aspectos: la interacción entre pluralidad de lógicas científicas nacionales (enfrentamiento de escuelas) y las situaciones de dependencia-autonomía que de ella resultan.

24- Migración de científicos y estrategias de reinserción

Pablo Kreimer

Organizaremos esta presentación en dos partes. En primer lugar, nos habremos de referir a las diferentes características que, en líneas generales, han presentado las migraciones científicas (incluyendo el retorno al país de origen), y que nos darán algunos elementos para comprender la situación de América Latina. En la segunda parte describiremos algunas líneas para la comprensión de lo que hemos denominado estrategias de reinserción de los científicos de regreso al país de origen.

25- La experiencia del Pedeciba como punto de inflexión en las migraciones científicas de la comunidad « basica » uruguaya

Adriana Barreiro Diaz, Léa Velho

La constitución del « Programa de Desarrollo de las Ciencias Básicas » (Pedeciba) hizo posible, en el Uruguay de fines de los años 80, el retorno de un gran número de miembros de la comunidad de científicos de las ciencias básicas que, por diferentes razones motivos, habían emigrado en el transcurso de la década de los años 70.

A pesar de las persecuciones del régimen militar en el país (1973-1985), la idea de que abandonar el país era algo « cuasi natural », más las muy escasas posibilidades y las difíciles condiciones ofrecidas por la situación académica imperante en cada *locus* institucional, principalmente nucleados en torno a la Universidad de la República y dos centros de investigación ubicados en la órbita estatal, hemos encontrado que mientras un buen número de científicos emigró, otros permanecieron trabajando en el país. Pero gracias al trabajo de vinculación del Pedeciba quienes abandonaron el país -y se encontraron sometidos al *ethos* científico propio de la comunidad de destino- y quienes optaron por permanecer, aunaron esfuerzos con quienes estaban fuera de las fronteras.

Teniendo en cuenta la importancia de los índices de emigración de cientistas como un todo (durante el decenio 1970-1980 se estima que emigraron del Uruguay unas 280.000 personas, más del 10 % de la población total del país hacia esa época) ; las peculiaridades inherentes al marco de la comunicación y los estrechos vínculos mantenidos intra e intergrupos ; la férrea intención de muchos de regresar a su país y contribuir al desarrollo de la ciencia local ; el interés manifiesto por consolidar equipos de investigación, alcanzar una « masa crítica » en cada una de las áreas del Programa (Biología, Física, Informática, Matemática y Química) y, fundamentalmente, llegar a contar con los repatriados como pilares para la formación de recursos humanos -vía la implementación de las primeras maestrías y doctorados en ciencias básicas del Uruguay-, y todo esto unido a la ayuda brindada por varios organismos internacionales : CEE, Pnud y Unesco, el soporte de propia Universidad, y el apoyo de las nuevas autoridades democráticas- dieron lugar a la « migración inversa » que hoy, da lugar a una nueva historia de las ciencias básicas, y a una vibrante y renovada migración de corte « estudiantil » de los jóvenes cientistas uruguayos. La ida y del regreso de los profesores fue percibida como una incitación por parte de muchos estudiantes.

26- Modelos de migración universitaria desde la China

Shaoni Tang, Paul Robins

Esta ponencia describe una investigación diseñada para identificar formas de mejorar las tasas de retorno de los estudiantes chinos en el extranjero. El enfoque principal del estudio se hizo sobre los estudiantes que son patrocinados por el gobierno chino y por universidades.

Durante los últimos 16 años, China introdujo reformas que abrieron sus puertas al mundo exterior. A este período, 220.000 estudiantes han sido enviados al extranjero para adelantar estudios superiores o capacitarse, de los cuales 120.000 fueron patrocinados por el gobierno chino y por las universidades. La mayoría de ellos fueron a Estados Unidos y Canadá y una minoría a Japón, Alemania, el Reino Unido, Francia, Australia y Nueva Zelandia.

El programa académico es uno dentro de varias iniciativas chinas que intentan traer experiencia y conocimiento sobre ciencia y la tecnología avanzada a China para promover la transformación y mejoramiento de su sistema educativo después de su reforma política y económica. Fue planeado como una parte importante del proceso de modernización de la economía China, particularmente en el desarrollo científico y tecnológico.

En la práctica, sin embargo, la contribución potencial ha sido reducida por la demora en el retorno de muchos académicos. Entre 1979 y 1993, un estimado de 43.3 % de los académicos patrocinados no volvieron después de una ausencia bastante prolongada.
La investigación reseñada aquí fue realizada para desarrollar el conocimiento y la comprensión necesaria para los entidades patrocininadoras para seleccionar y manejar las relaciones de intercambio de manera más efectiva (en términos de la prontitud en el retorno). El estudio está dividido en dos partes ; la primera es un análisis del comportamiento pasado de estudiantes y académicos (se tomó una muestra de 2035 de cuatro universidades chinas) y la

segunda es un estudio realizado a través de un cuestionario de las motivaciones expresadas por los estudiantes chinos actualmente en el extranjero (en el Reino Unido). Aquí se han analizado las relaciones entre las tasas de retorno, edad, duración de los programas, los países anfitriones y las entidades patrocinadoras ; la encuesta sobre motivación se realizó con el fin de identificar las posibilidades de influenciar las tasas de retorno de los estudiantes (más allá de recurrir a las restricciones de los contratos legales). Un análisis preliminar sugiere que cualquier cambio que se haga para estimular el pronto retorno debería animar también la migración interior.

La conclusión de este documento refleja los objetivos del estudio y evalúa el valor de los programas de intercambio de estudiantes para China.

27- InversiÓn del « Brain drain » en Hong Kong ?

Wenhui Zhong

Durante las entrevistas que hice en la Navidad del 1994, para un programa del Servicio Mundial de la BBC sobre los retornados a Hong Kong, encontré que los estudiantes chinos en el extranjero retornaban en número creciente a Hong Kong para trabajar. Después del éxodo de los chinos de Hong Kong hacia los países occidentales a finales de los ochenta, los patrones de emigración se han reservado. Entre los retornados que tienen pasaporte extranjero, un significante número de ellos corresponde a los que se fueron a los países occidentales como estudiantes desde China y ahora representan compañías multinacionales en Hong Kong, con la visión de explotar el mercado chino.

Estos profesionales con pasaporte extranjero, representan cerca de 60.000 personas, en una población de 6 millones en Hong Kong. Es una fuerza crucial en el objetivo de mantener la reputación de primera clase de Hong Kong como un centro internacional financiero y puente entre el Este y el Oeste.

La mayor parte de las entrevistas han mostrado optimismo reservado acerca del futuro de Hong Kong. Muestran ambivalencia acerca de su identidad cono chinos o como la de la nacionalidad adoptada. No existen demasiadas preocupaciones relacionadas con el lugar al cual pertenecen, solo quieren ejercer su profesión. Otros asuntos explorados en este estudio son las relaciones inter-raciales, choques/ajustes culturales y problemas de la separación de las familias.

28- La cabeza corriente : la perspectiva pendular como alternativa viable a la perspectiva de la fuga de cerebros, con ejemplos de la China

Paul Pedersen, Ko Shan Lee

La ponencia presenta y discute los patrones de toma de decisiones sobre el retorno al país de origen luego de los estudios en el exterior basado en datos cuantitativos y cualitativos sobre los estudiantes en ingeniería de Taiwan que estudian en los Estados Unidos. Estos datos fueron recogidos a través de la investigación. Se revisa a literatura sobre el retorno de estudiantes, se presentan casos específicos y se presentarán sugerencias para continuar el estudio sobre el tema del retorno de estudiantes en el exterior.

29- Inversión del brain drain coreano desde los años 1960 a los 1980

Ha-Zoong Song

La fuga de cerebros, y su potencial reversión, es un significativo fenómeno en el mundo, con profundas implicaciones para el desarrollo de varias naciones y la distribución geográfica del flujo de la innovación tecnológica. Durante la polémica sobre el brain drain de los años sesenta, algunos analistas creyeron que los incentivos sociales y económicos podrían atraer personas talentosas desde los países en vía de desarrollo para emigrar hacia los países avanzados.

Debido a los recursos disponibles en los países en desarrollo en ese entonces, este problema parecía poco probable de ser rápidamente resuelto. Hoy, la mayoría de los países del Tercer Mundo pierden aún sus mejores talentos. Sin embargo, en los últimos años, ha habido un impresionante incremento en la proporción de coreanos que regresan a casa después de recibir educación en los Estados Unidos. De hecho dos tercios de coreanos que han obtenido doctorados en instituciones de los Estados Unidos en los campos de las ciencias naturales y la ingeniería (llamados más adelante « KSEs ») durante la década de los ochenta han retornado a Corea dentro de los tres años siguientes a la obtención de su título. Taiwan ha experimentado una similar acometida de retorno de expatriados. Tanto el tradicional brain drain como el regreso no previsto de los expatriados a largo plazo (« reverse brain drain ») plantea complejos temas para las políticas de naciones como Corea y Taiwan. Como país pobre en recursos naturales, Corea busca un retorno de la inversión hecha en las personas para mantener su impulso hacia el progreso.

Para establecer las implicaciones políticas del *brain drain* y la repatriación entre los KSEs, se recolectó información entre dos grupos de KSEs (432 en los Estados Unidos y 406 en Corea), utilizando un cuestionario a través del correo y entrevistas personales. Los cuestionarios brindaron información sobre la situación familiar de los KSEs, su trabajo y su carrera, sus percepciones y actitudes, mientras que los indicadores de la situación externa (económica, social y política) sobre los Estados Unidos y Corea fueron tomados de estadísticas publicadas. Se analizaron los datos utilizando diversos enfoques complementarios :

1) Una comparación descriptiva de KSEs que regresan a Corea y aquellos que se quedan en los Estados Unidos.
2) El análisis de la discrepancia observada entre las intenciones y las acciones de los KSEs, y
3) La evaluación de los efectos de cada factor de decisión en la elección de residencia basado en un análisis discreto de elección.

Los resultados del análisis son los siguientes : Aunque las condiciones económicas ejercen una influencia crítica en las tendencias de la tasa de retornados, los efectos de factores intangibles, arraigados en las diferencias culturales en los dos países se hace más evidente según la economía coreana mejoraba en los últimos años. Cuando la diferencia de las condiciones económicas entre alternativas se vuelve menor, los factores psicológicos y emocionales se vuelven más importantes. En particular, el análisis sugiere que los valores confucianos funcionan como un elemento subyacente en las decisiones de los KSEs. Debido a que el prestigio ligado a los trabajos en la enseñanza es un gran factor que afecta las decisiones de la élite educada, portan un gran prestigio dentro de la jerarquía de la estructura confuciana de valores de la sociedad coreana. confuciana trabajos educativos han sido tradicionalmente una Igualmente, la responsabilidad sobre la familia, tanto en Corea como en los Estados Unidos, es un factor crítico en la toma de decisiones. Consecuentemente, este estudio señala la importancia de los factores culturales en la formulación de políticas sobre el fenómeno del *brain drain.*

30- Expertos tunisianos en el extranjero : una mayor contribución al desarrollo nacional

Belgacem Henchi

Desde su independencia en 1956, Tunisia ha venido motivando la escolarización desde 1990. Sin embargo la infraestructura de la capacitación universitaria no se ha desarrollado a la misma velocidad que la escuela primaria y secundaria ; sobre todo en el campo de las tecnologías importantes. Dicha situación condujo al estado, durante mucho tiempo, a enviar a los estudiantes mas inteligentes al extranjero (Europa y los Estados Unidos) tanto para una capacitación universitaria como para una especialización mas profunda (una Diploma de Estudios Avanzados, la tesis, una pasantía de capacitación especializada...).

Muchos estos diplomados que se enviaron se quedaron en los países que los acogieron, y esto por múltiples razones. El numero es bastante elevado, ellos permanecen esencialmente en Francia, Canadá y USA. Paralelamente, un cierto numero de científicos tunecinos de fama internacional fueron atraídos por ofertas tentadoras hacia laboratorios europeos, americanos (USA, Canadá) y las universidades de los países del Golfo. Consciente de esta fuga de competencia, después del cambio de 1987, Tunisia ha tomado una serie de medidas que tiene como objeto limitar nuevas fugas de cerebros, la repatriación de tunecinos cuando esto es posible, y la colaboración científica con aquellos que deseen permanecer en el país de adopción.

31- Emigración de científicos : el caso de Uruguay

Adela Pellegrino, Wanda Cabella

La convocatoria a esta reunión plantea el interesante desafío de volver la mirada al tema de la emigración de sectores altamente calificados, en este caso particular, de los científicos. Los organizadores proponen además la necesidad de replantear, a la luz de las transformaciones que esta sufriendo el mundo contemporáneo, la conceptualización de esta discusión.

En esta ponencia voy a referirme a dos aspectos de la cuestión. En primer lugar, al estado de discusión sobre el tema en la literatura migratoria. En segundo lugar ubicaré el caso de Uruguay en este contexto, aún cuando la investigación sobre el tema presenta en este país, un atraso considerable.

32- Migraciones científicas, redes de cooperación y desarrollo en América Latina y el Caribe

Guillermo Cardoza, Raimundo Villegas

Los países de América Latina se encuentran comprometidos en la reestructuración de sus economías con el propósito de superar la crisis que los ha mantenido en el estancamiento económico y social desde comienzos de los años ochenta. Los procesos de apertura y liberalización en curso plantean la necesidad de diseñar e implementar políticas tecnológicas orientadas a la creación y consolidación de una capacidad de innovación que sustente los aumentos de productividad y competitividad requeridos para participar en las corrientes más dinámicas del comercio internacional. Para la realización de esta compleja tarea, se necesita, además de políticas bien definidas y de recursos financieros, de la participación de recursos humanos de alta calificación. Sin embargo, los importantes esfuerzos realizados en la formación de los recursos humanos en la región están siendo seriamente amenazados por el incremento de los flujos migratorios de científicos, ingenieros y profesionales hacia los países industrializados.

Hasta hace pocos años los análisis de las migraciones de personal de alta calificación de los países en desarrollo hacia los países desarrollados se centraron en la determinación de las causas y motivaciones de la migración del personal calificado, fenómeno conocido como fuga de cerebros -brain drain- y en el diseño de las políticas de repatriación para contrarrestarla. En estos estudios se intentaba diagnosticar y cuantificar el tamaño de los flujos migratorios y su impacto económico y social. Hoy en día, si bien este enfoque continúa prevaleciendo en los análisis, el desarrollo de las nuevas tecnologías de telecomunicación, en particular de las redes telemáticas, permite plantearse el problema desde una perspectiva distinta colocando el énfasis en la posibilidad de convertir la emigración en un ‘brain gain’ mediante la cooperación que puedan brindar los talentos emigrados.

En el presente trabajo se hace énfasis en las posibilidades de cooperación que ofrece la vinculación de los emigrados y se intenta aportar elementos de respuesta a las siguientes preguntas : ¿cómo pueden los países en desarrollo recibir apoyo de sus científicos, ingenieros y demás profesionales emigrados hacia los países desarrollados ? ; ¿qué elementos deben ser considerados en el

diseño y aplicación de políticas gubernamentales y estrategias corporativas para la vinculación de los emigrados ? y ¿qué estructuras institucionales pueden garantizar el uso óptimo de la cooperación de los recursos humanos emigrados y qué papel deben cumplir los gobiernos en la construcción de las mismas ?

Para cumplir con estos objetivos, en el presente trabajo se estudia : en la primera sección, el fenómeno de las migraciones en el contexto de los procesos de 'globalización excluyente'que caracterizan las transformaciones en curso de la economía mundial y se hace una rápida síntesis de los principales aspectos considerados en diversos trabajos sobre la migraciones. A continuación, en la segunda sección, luego de analizar brevemente el impacto que tienen estas migraciones sobre el desarrollo regional, se plantea la conveniencia de avanzar en la construcción de la Comunidad Científica Global de América Latina y el Caribe a través de la creación de Redes Globales de Cooperación para la Innovación que incorporen los recursos humanos calificados residentes dentro y fuera de la región a la nueva estrategia de desarrollo regional. Se evalúa su utilidad como mecanismo de transferencia de conocimientos en el proceso de 'aprender a innovar'. Seguidamente, se aborda el análisis de las redes destacando sus características y ventajas, su estructura y morfología y el papel que desempeña el Estado en su promoción y aprovechamiento en beneficio del desarrollo.

Finalmente, se presenta brevemente el proyecto 'Base de datos de investigadores y profesionales de América Latina y el Caribe residenciados fuera de la región', realizado conjuntamente por la Academia de Ciencias de América Latina (ACAL), la Association Latinoamericaine de Scientifiques (ALAS) y la Unesco, y se propone la creación de un Fondo Regional para la Cooperación Científica destinado a promover la cooperación entre los investigadores residentes en los países de la región y de éstos con sus colegas emigrados hacia los países desarrollados.

33- « En contacto con Venezuela » Conicit : diseño y asesoria de políticas

Iván de La Vega

El Consejo Nacional de Investigaciones Científicas y Tecnológicas (Conocit) promueve un proyecto denominado « En contacto con Venezuela », el cual intenta vincular a los profesionales venezolanos radicados en el exterior, con los diferentes actores del Sistema Nacional de Innovación, utilizando la plataforma comunicacional instalada de la Red Académica de Centros de Investigación y Universidades Nacionales (Reacciun).

Paralelamente plantea una estrategia de prevención de la potencial emigración de estudiantes y profesionales en formación. Finalmente contempla una estrategia de retorno, mediante un fino monitoreo de las posibilidades y condiciones, tanto del país, como del postulante. Dicha estrategia está muy ligada a la información del potencial científico y tecnológico venezolano.

34- La dialéctica de lo virtual y de lo concreto en la Red Caldas

Bernard Schlemmer, Jacques Gaillard, Dora Bernal, Nora Narvaez-Berthelemot

A la Red Caldas se le conoce como una red electrónica que agrupa, gracias a Internet, a los investigadores colombianos expatriados. La idea con esta red es crear - o recrear - con ella una comunidad científica nacional, a pesar de la gran dispersión geográfica de ésta. Pero, obviamente, esta comunidad sólo puede tomar cuerpo si sus miembros « siguen el juego », es decir, si se sienten tanto miembros de la comunidad nacional de origen como se sienten miembros de la comunidad científica internacional, y saben movilizarse en consecuencia.

Ahora bien, para personas que se han ido de Colombia a veces desde

hace mucho tiempo, identificarse con lo que está en juego con respecto al desarrollo nacional no es algo que se logra automática ni inmediatamente. Se necesita hacer un significativo trabajo de motivación para movilizar dentro de una obra colectiva a esta población volátil. Actualmente la red está constituida por 21 ‘nudos’, o asociaciones locales de intelectuales colombianos o colombianistas en su país de residencia, dotados de personalidad jurídica o a punto de estarlo. Cada nudo local posee sus características propias ligadas a la historia de su constitución, a la población de su diáspora, etc. El nudo suizo, por ejemplo, es uno de los más dinámicos en cuanto a la puesta en marcha de proyectos científicos internacionales que asocian a investigadores colombianos que trabajan en laboratorios helvéticos, a investigadores colombianos que se han quedado en el país y a investigadores extranjeros, suizos o no ; no obstante, este nudo se ha mantenido demasiado centrado en las ciencias « duras » : prácticamente no hay en dicho nudo un lugar para las ciencias humanas, y menos aún para las personas para quienes la investigación científica constituye un centro de interés pero que no son investigadores de profesión. A la inversa, el nudo New Yorkino cuenta con una fuerte proporción de colombianos que no son investigadores sino más bien artistas, literatos, miembros de profesiones liberales, etc., y desarrolla no solamente intercambios científicos, sino que lleva a cabo toda clase de actividades sociales y culturales (ayuda mutua y de otros tipos).

El nudo francés se situaría entre estos dos extremos, con una fuerte representación de investigadores en ciencias sociales, pero pagando con ello el precio de sufrir tensiones innegables con los investigadores de las ciencias exactas ; éstos tienen la impresión que el nudo pierde con ello su alma, su especificidad y - desde el punto de vista de los resultados que esperaban personalmente de él - pierde también su interés ; la tensión ha llegado a tal punto que algunos han abandonado la asociación. Algunos nudos se caracterizan por una concentración en un ámbito particular, como las ciencias médicas en el caso del nudo sueco, en Estocolmo, cuya mayoría de miembros trabaja activamente en el prestigioso instituto Karolinska.

Tal diversidad de nudos es sin duda alguna un signo de vitalidad, pero revela, asimismo, la contradicción interna del proyecto : el modelo se basa a la vez sobre el postulado de una ciencia universal - por lo que hay que dejar a los investigadores colombianos en los laboratorios del Norte - y sobre el patriotismo de los investigadores : éstos deben sentirse colombianos, movilizarse, militar, para que funcione la red. Mientras más científicos se consideren, más querrán que la Red Caldas se vuelva una red científica internacional, dando prioridad al intercambio con sus pares, sin preocuparse demasiado sobre los colegas un poco alejados de su ámbito, quienes bajo el pretexto de ser colombianos buscarían beneficiarse de la red ; en esta concepción la ciencia no tiene fronteras. De manera inversa, mientras más colombianos se consideren, más cederán a la tentación de transformar la red en una red de intercambio y de ayuda, diluyendo su potencial estrictamente científico, y perdiendo con ello a los colegas que se situarían más bien en la primera concepción.

De esta manera tenemos un desfase entre el modelo de red dominante en el discurso oficial sobre la Red Caldas, es decir el que se basa meramente en el plano de la red electrónica, y el modelo real llevado a la práctica por la mayoría de sus miembros, incluso aquellos que se consideran miembros activos. En el modelo teórico, gracias a la red electrónica, el mundo de la ciencia se ha convertido en una aldea, se ha abolido la distancia y cada uno puede dialogar con cualquier otro como lo hace con su vecino. En los hechos, puede que el mundo sea una aldea, pero hay que admitir entonces que son pocos los que se encuentran en la plaza mayor, en el foro : el diálogo se limita a la casa de familia, cuyas persianas quizás estén entreabiertas, pero cuya puerta está cerrada. Por lo demás, quienes se sirven del correo electrónico, lo hacen general-

mente para mantener contactos con Colombia, más que para abrir el diálogo con otros investigadores de otros países : la estructura de las comunicaciones de los investigadores colombianos expatriados vinculados a la Red Caldas no se parece a una telaraña de conexiones múltiples, sino a una estrella cuyo centro es Colombia.

Desarrollaremos estas observaciones apoyándonos en los casos de los nudos estudiados en Austria, Bélgica, Estados Unidos de América, Francia, México, Suecia y Suiza.

35- Las potencialidades de la Red Caldas de investigadores colombianos en el exterior

José Granés, Alvaro Morales, Jean-Baptiste Meyer

La Red Caldas de investigadores e ingenieros colombianos en el exterior constituye una propuesta de política científica novedosa, diseñada con el propósito explícito de vincular a los científicos expatriados al desarrollo de la ciencia en el país. A través de la red se han puesto en práctica distintas modalidades de vinculación y cooperación entre las cuales pueden señalarse la evaluación de proyectos de investigación elaborados en Colombia, los intercambios de información y de servicios, las pasantías por períodos limitados de tiempo, la participación en seminarios y otro tipo de eventos, las asesorías y, finalmente, la elaboración y el desarrollo de proyectos conjuntos de investigación. Esta última modalidad de cooperación es, sin lugar a duda, la que más impacto puede tener, en el largo plazo, sobre el desarrollo de la ciencia en Colombia. La realización de proyectos conjuntos a nivel internacional puede llegar a constituir, en efecto, una transferencia significativa de cultura científica para el país y la construcción de nexos estables con centros científicos y tecnológicos de nivel internacional.

En la Red Caldas se han iniciado, con éxito variable, diversos intentos de elaboración de proyectos conjuntos. El examen de algunas de estas iniciativas puede arrojar luz sobre las potencialidades y, también, sobre las limitaciones de la red. También puede ayudar a clarificar las formas de operación y los mecanismos que pueden ponerse en acción para gestar, negociar y convencer a distintos actores y poner en marcha este tipo de proyectos.

Examinaremos, en esta ponencia, tres intentos de elaboración de proyectos conjuntos a través de la red : un proyecto multilateral que involucra investigadores en distintos países europeos y latinoamericanos que se ha denominado « proyecto BIO-2000 », un proyecto de transferencia tecnológica en el área de la robótica ya finalizado en una primera etapa y un proyecto, que no logró constituirse, entre un instituto colombiano de investigación para la salud y un instituto homólogo en Suecia. En cada caso intentaremos sacar a la luz el papel que ha jugado el aún tenue tejido de relaciones en proceso de consolidación a través de la Red Caldas.

36- El proceso creativo en la migración : desde la migración a la creatividad en la Red Caldas. Aproximaciones psicoanalíticas

Beatriz Miramón Archila

La migración puede asimilarse a la « situación traumática » con las alteraciones psicopatológicas propias de este cuadro. La calidad del trauma viene dada por la suspensión súbita de las habitualidades del mundo externo. En el mundo interno del migrante, resalta, la pérdida de la identidad, pues en la mayoría de los casos se difumina las peculiaridades individuales, familiares y comunitarias, constitutivas de sí misma.

La creatividad, en estos casos, es un resultado de la forma como el sujeto logra transformar las situaciones de confusión, caos y dolor mental, en factores para su crecimiento. Constituye una paradoja puesto que la situación de conflicto puede entrar en una suerte de contrapunteo con el desarrollo de la creatividad, como uno de los elementos estimulantes. Se trataría en términos psicoanalíticos de

la posibilidad de elaborar un duelo que permita al sujeto realizar un nuevo reordenamiento psíquico.

Conocidas las dificultades del proceso migratorio y las posibilidades creativas a las que puede llevar el suceso, mediante la reconstrucción de una nueva identidad en el exterior, su estudio podría enriquecer la observación de las migraciones y aún prevenir o ayudar en las situaciones graves y deteriorantes, cuando la resolución es de tipo negativo y desintegratorio del psiquismo.

Sería interesante discutir las ideas de este trabajo con los objetivos de la red Caldas, profundizando en qué medida facilita o enriquece el proceso.

37-Tecnología de la información como mecanismo de busqueda para la recuperación de talentos

Greta Pifat, Virginia Cano

Esta ponencia explora el uso de la tecnología informática en el desarrollo y mantenimiento de una base de datos de científicos emigrados. Específicamente, la ponencia aborda el uso de los servicios vinculados al Internet tales como listas de discusión para identificar y entrar en contacto con científicos que han emigrado de países en vía de desarrollo hacia los países industrializados del Norte, y que desean mantener y renovar contactos con sus países de origen. La ponencia explora los aspectos metodológicos del uso de la Internet pa establecer contactos con científicos y muestra el uso de la tecnología del correo electrónico para recobrar y mantener una base de datos actualizada y consultable de científicos.

La ponencia presenta el caso de Croacia como un estudio de caso sobre las condiciones que generan la migración de científicos, detalla los esfuerzos de diversos individuos para mantener los contactos con comunidades de emigrantes y muestra cómo esta base de datos podría ser usada para beneficio de los científicos emigrantes, los diseñadores de políticas para la ciencia, científicos y jóvenes científicos en este país.

38- Internet y la globalización de la comunidad científica nacional Un estudio empírico

José Granés, Jean-Baptiste Meyer

Colombia, Sur América, es el primer país que ha implementado el « programa diáspora », que pone en relación a sus científicos e ingenieros expatriados en todo el mundo con sus pares en el país mediante la llamada « red Caldas ». Uno de los principales instrumentos de comunicación de esta red es una lista electrónica a la que están conectados la mayoría de sus participantes. Desde los comienzos del programa, la lista ha servido tanto de espacio constitutivo como de instrumento colectivo de animación de la comunidad nacional y mundial en su proceso de construcción. En nuestro trabajo se presentan los resultados de un estudio sobre los cuatro años de la « red Caldas » y los tres años de vida de su comunicación electrónica, desde enero de 1993 hasta diciembre de 1995. Planeamos proceder a través de tres puntos :

1- los desarrollos compartidos de la red y de la lista a través de su historia,

2- un análisis estadístico de 1027 mensajes intercambiados durante el período de tres años, material procesado mediante una base de datos,

3- una evaluación del impacto efectivo que tiene la comunicación electrónica en la extensión de la comunidad científica mas allá de su frontera.

Los resultados empíricos que proporciona el estudio son abundantes. A veces el estudio confirma algunos estudios basados en nuevas tendencias sociales generadas por Internet, pero también contradice otras presunciones. Lo importante es que las pruebas reunidas permiten evaluar consideraciones fundamentales sobre el fenómeno del Internet en la ciencia y la tecnología.

39- Perspectivas de análisis estadístico en el estudio de migraciones de científicos y profesionales

Alvaro Montenegro

Se presenta el proceso metodológico seguido para llevar a cabo la encuesta « Redes Colombia », dentro del marco del proyecto de investigación « El brain gain revisited a través del caso colombiano. Estudio de la Red Caldas ». El objetivo del proyecto es hacer un análisis profundo de la población de investigadores colombianos expatriados, organizados principalmente alrededor de la red Caldas. La encuesta fue enviada a los investigadores colombianos expatriados que este grupo de investigación localizó en 24 países. Se emplearon diferentes medios de envío de la encuesta, entre ellos principalmente el correo aéreo y el correo electrónico.

Résumés

3- Politiques et programmes de migrations des ressources humaines qualifiées

Lelio Mármora

La transnationalisation de la production, avec la résultante croissance des sociétés transnationales, le développement économique de certain pays, les changements de plus en plus importants dans l'organisation des méthodes de production et les nouvelles structures de communication sont des éléments qui ont déterminé une augmentation dans la mobilité des ressources humaines qualifiées (RHQ).

Quantitativement, cette augmentation ne représente qu'une partie des migrations internationales. Néanmoins, elle a une importance significative en raison de ses coûts et bénéfices, dans le domaine public aussi bien que privé.

À son tour, la théorie sur les migrations a été énormément affectée par ces mouvements, souvent de courte durée, Ce qui a emmené à repenser ces mouvements et la pertinence même de la notion de « migration ».

Le questionnement et la réflexion sur ces éléments constituent la base des diverses parties de cet article.

Dans la première partie, nous analysons les implications conceptuelles des termes tels que « drainage de cerveaux », « exode de compétences », « transfert de technologies », « échange de qualification » et le rapport de ces termes avec les processus de migration.

Dans la deuxième partie, nous présentons quelques réflexions concernant le rapport coûts-avantages des migrations de RHQ, et son rôle en tant que fondement des politiques migratoires.

Dans la troisième partie, nous développons les diverses politiques et programmes publics sur les migrations, tels que la rétention et récupération des migrants qualifiés, ainsi que la réglementation et la libéralisation des migrations.

Dans la quatrième partie, nous analysons l'évolution des politiques privées concernant cette problématique.

4- Les migrations internationales de personnes hautement qualifiées : un itinéraire bibliographique et conceptuel

Anne Marie Gaillard, Jacques Gaillard

À partir de différentes sources documentaires (dont sept bases de données et une dizaine de bibliographies déjà constituées), un corpus bibliographique de 1 808 références de travaux écrits entre 1954 et 1995 et traitant strictement des migrations internationales de personnes hautement qualifiées a été constitué et réuni dans une base de données.

Cette communication porte sur les caractéristiques de la production identifiée. Des indicateurs bibliométriques classiques, tels la chronologie des publications, l'identification des auteurs les plus prolifiques, le repérage des principaux journaux et des institutions clés, permettront de cartographier l'intérêt porté sur le thème au cours de la période considérée.

Une approche qualitative rendue possible grâce à l'analyse d'un autre ensemble d'indicateurs tels les pays concernés par les travaux, la nature des publications, les thèmes abordés, permettra la différentiation des niveaux d'intérêt portés à la question au fil des temps. C'est ainsi que l'on verra comment la question des migrations de personnes hautement qualifiées, d'abord considérée à travers l'émigration des étudiants comme un phénomène positif per-

mettant un transfert de technologie des pays riches vers les pays pauvres (en prenant pour certain que les étudiants rentraient dans leur pays après leur migration) a ensuite été perçue comme une perte sèche par les pays d'émigration lorsque l'on a cru comprendre que les étudiants ne reviendraient peut-être pas. Sur cette base, ce thème est devenu un des sujets théorique des plus controversés (en termes de « qui perd et qui gagne ») dans la décennie 1970 puis un sujet de travail des conférences internationales sur le thème du développement, mais depuis la fin de la décennie 1980 il revêt à nouveau un caractère positif dans un contexte de globalisation des échanges où ces migrations commencent à apparaître comme un phénomène potentiellement bénéfique pour le pays d'émigration.

Outre ces résultats, l'objectif de cette communication est d'introduire un outil : la bibliographie elle-même, laquelle représente une base scientifique solide pour quiconque veut approfondir ses connaissances dans le domaine cité et constitue un des éléments primordiaux pour réaliser « l'état de l'art » sur la question des migrations internationales de personnes hautement qualifiées.

5- La migration des scientifiques à travers les âges : changements de modèles migratoires

Enrique Oteiza

Pour comprendre la nature spécifique de ce type de migration sélective contemporaine (partie de ce qu'on a appelé fugue de cerveaux, *brain drain*), et pour comprendre ses différences avec d'autres phénomènes migratoires, il est utile de revoir des références historiques pertinentes. Dans l'histoire de la Science et de l'Université, d'après des textes tels que ceux de G. Sarton, C. A. Parsons, F. H. Powicke, H. Waddell et d'autres, il ressort deux aspects importants des migrations de scientifiques et intellectuels. Le premier concerne la haute mobilité de ces chercheurs, par rapport à d'autres groupes dans leurs sociétés d'origine ; le deuxième est le rôle que les politiques explicites d'attrait ont joué dans le développement de ces mouvements. Le phénomène actuel de fugue de cerveaux a permis à certains pays d'incorporer, dans les 50 dernières années, des centaines de milliers d'immigrants hautement qualifiés. En revanche, auparavant, des processus migratoires de ce type, dans des laps de temps similaires, ont affecté, tout au plus, quelques centaines de personnalités du monde intellectuel et scientifique de l'époque.

C'est à partir de la Première Guerre mondiale que des pays d'origine et de destination des principaux flux migratoires internationaux, selon leurs intérêts respectifs, commencent à définir et à appliquer des politiques visant à retenir ou à attirer des personnes ayant des qualifications données, des scientifiques entre autres. Après la Deuxième Guerre mondiale, les politiques migratoires deviennent plus précises en ce qui concerne le personnel scientifique et technique de haut niveau. Les pays ayant un degré plus élevé de développement relatif, à savoir les pays avancés dans l'industrie et la science, exercent une attraction à travers de multiples mécanismes qui leur permettent de concevoir et de mettre en pratique des politiques migratoires sélectives.

Dans ce document nous examinerons, également, les caractéristiques des différentes phases par lesquelles a traversé ce système de migration sélective, depuis la Deuxième Guerre mondiale.

6- Les migrations des scientifiques dans l'histoire de la science au sein des sociétés totalitaires

Yakov Rabkin

La transition vers ou depuis un système totalitaire peut conduire à la migration de scientifiques. Cette étude présente les migrations de scientifiques à partir d'une perspective comparative, observant dans un

premier temps le cas de trois pays européens qui ont connu des régimes totalitaires et qui, parallèlement, ont développé des infrastructures de recherche et ont formé des scientifiques de renommée internationale : l'Union soviétique, l'Italie de Mussolini et l'Allemagne d'Hitler.

Cet exposé est fondé sur les considérations préliminaires suivantes. Le terme « totalitaire » fait ici référence aux sociétés qui ont connu des tentatives de « contrôle total » au cours du XX^{e} siècle. Ce concept prête à controverses et a souvent été utilisé de manière polémique. Cependant, des travaux récents sur la nature des modèles de totalitarisme soviétique et allemand ont toujours recours à ce concept. De plus, un intérêt prononcé pour l'étude sur le totalitarisme, incluant des travaux sur les relations entre le totalitarisme et la science, a émergé un peu partout en Europe depuis les années 1980. Dans cette étude, le terme « science » inclut principalement les sciences naturelles, médicales et exactes. L'accent mis sur les sciences naturelles se justifie par le caractère plus transnational généralement admis de la connaissance scientifique et son identification concomitante avec l'internationalisme scientifique par beaucoup de chercheurs travaillant dans ces domaines.

La science et le totalitarisme n'ont pas besoin d'être considérés comme victime et bourreau, une bonne partie de la littérature existante sur le sujet rend compte de cette dichotomie. Les deux entrent en conflit et se renforcent réciproquement. Les rôles de la science dans la constitution du contenu politique de ce siècle méritent d'être étudiés, particulièrement dans la mesure où celle-ci est souvent négligée en tant qu'élément servant à la constitution des idéologies totalitaires.

L'exode des scientifiques depuis les pays totalitaires et leur relation avec la communauté scientifique qu'ils laissent derrière eux est un phénomène lié au thème « Résistance/Collaboration ». Par ailleurs, ce phénomène est lié aux controverses entourant les relations scientifiques internationales dans les sociétés totalitaires. Tous ces régimes mettent l'accent sur l'isolement et l'autarcie, certains d'entre eux différenciant explicitement le monde scientifique de la science orientée idéologiquement sous un régime donné (la « Physique allemande » ou la « Biologie marxiste »).

Pourtant la science, principalement à cause de sa signification stratégique et diplomatique pour les dirigeants totalitaires, était autorisée (et occasionnellement même encouragée) à engager des relations avec l'étranger bien que ces relations fussent limitées et firent l'objet de manipulation.

7- Migration et construction de la coopération scientifique : le cas du réseau Caldas

Jorge Charum

L'option diaspora est une nouvelle perspective de récupération des capacités en science et technologie (S & T) des émigrés nationaux. À la différence de l'option « brain gain » - laquelle, pour assurer la réinsertion dans le pays d'origine des scientifiques et ingénieurs émigrés, requière une compréhension plus précise du besoin de disposer de structures locales pour l'accueil des scientifiques et ingénieurs émigrés - l'option diaspora considère que la création de liens de coopération et de collaboration entre les émigrés et la communauté scientifique nationale est plus importante que le retour physique des expatriés. Ces liens permettent d'organiser un réseau de relations socio-techniques orienté vers la création d'une capacité scientifique nationale, par le biais de la participation et des contributions délocalisées des membres de la diaspora. Le réseau et ses dynamiques sont déterminés par : a) l'action d'acteurs multiples - chercheurs, groupes de recherche, programmes nationaux de recherche, responsables des politiques nationales et institutionnelles... qui, de part leur position particulière et leurs intérêts, participent à la construction d'un réseau par lequel circulent des projets, des personnes, des problèmes, des équipements, de la documentation ; b) la coopération et collaboration d'acteurs de la recherche situés à l'intérieur et à l'extérieur des frontières natio-

nales s'appuyant dans les structures de recherche où ils s'insèrent ; c) la mobilisation des connaissances assemblées et des expériences obtenues par les scientifiques émigrés, lesquelles permettent de concevoir, entreprendre et maintenir des projets conjoints avec les membres de la communauté scientifique à l'intérieur du pays.

Le réseau Caldas est un exemple de cette nouvelle approche dans le champ de la S & T. Sur la base des publications des membres expatriés du réseau et du repérage de leurs activités actuelles, il est possible d'établir des connaissances et des ressources accumulées et des potentialités de coopération dans des domaines spécifiques. Grâce à la réalisation d'entretiens il a été possible de caractériser différents types d'acteurs et de modalités de participation dans la construction du réseau et dans l'entraînement de ses dynamiques. La connaissance actualisée des éléments mentionnés ci-dessus peut aider beaucoup dans l'orientation des politiques nationales et institutionnelles et des décisions stratégiques dans le domaine de la recherche.

8- Réseaux collégiaux et intégration des scientifiques russes immigrants en Israël

Nina Toren

Notre communication présente l'analyse et la comparaison de deux types de réseaux de scientifiques russes immigrés récemment en Israël. Le premier type se compose de scientifiques qui ont influencé intellectuellement la recherche d'autres scientifiques qui ont été identifiés par eux. Le second type de réseaux inclut les scientifiques qui ont fourni, au plan professionnel, une aide quelconque aux scientifiques étudiés. Par exemple ceux qui les ont aidés à utiliser de nouvelles techniques de recherche et ceux qui ont mis les nouveaux arrivés en contact avec des scientifiques et des institutions du nouvel environnement. Ces deux types de réseaux diffèrent l'un de l'autre par leur structure et de leur contenu. Mais tous deux sont importants puisqu'ils permettent une productivité soutenue et l'intégration des scientifiques immigrants dans une nouvelle communauté scientifique et dans un nouveau système de recherche.

9- Exode, récupération des compétences et communautés scientifiques : l'expérience indienne dans le champ des biotechnologies

Venni V. Krishna

Depuis que les pays en voie de développement comme l'Inde ont entrepris de construire une infrastructure institutionnelle moderne en Sciences et Technologie, les problèmes associés au processus de la fuite des cerveaux sont devenus, pour plusieurs champs de recherche émergents, un sérieux obstacle à l'établissement de capacités locales et nationales en sciences et technologie en vue du développement. L'expérience indienne montre que la formation d'un personnel qualifié en sciences et technologie sans l'existence d'un nombre viable de groupes de recherche ou de communautés de spécialistes, dans le sens sociologique du terme, mène avant tout à la migration de scientifiques expérimentés vers des lieux plus propices au travail et où il existe une demande de personnes à fortes capacités intellectuelles. Comme corollaire, le statut des communautés scientifiques et la professionnalisation des champs de recherche en sciences et technologie sont étroitement liés aux phénomènes de la fuite et de la récupération des cerveaux, qui ne peuvent être dissociés. La promotion et la croissance d'une communauté scientifique ou de groupes de spécialistes dans un champ donné de la science non seulement freinent le processus de la fuite de talents mais aussi, vu le climat de travail et le contexte intellectuel, favorise le retour de scientifiques émigrés. Cette conclusion s'appuie sur une étude empirique préliminaire entreprise auprès d'éminents groupes de recherche appartenant à des institutions scientifiques de premier plan. Des études de cas menées auprès de groupes de recherche dans les domaines de la biologie moléculaire,

de la biotechnologie et des télécommunications, révèlent de plus qu'il existe différents mécanismes de professionnalisation dans les champs des sciences et technologie orientés soit vers la « science » ou soit vers « l'industrie », avec de fortes implications pour la compréhension du phénomène de la fuite et du gain de cerveaux.

Pour un champ scientifique orienté, tel que la biologie moléculaire, plusieurs éléments cruciaux servent d'indicateurs de ce mode de professionnalisation : l'émergence d'un nombre viable de groupes de spécialistes, les cours universitaires pertinents au niveau du doctorat, l'existence de sociétés de professionnels et de canaux de communication (journaux) au sein du pays, l'interaction des scientifiques locaux avec des chercheurs sur la scène internationale, leur interaction avec des groupes internationaux par le biais des étudiants et des communications, et par l'acquisition d'une légitimité et d'une reconnaissance venant des canaux nationaux de financement. Les publications scientifiques spécialisées et la pertinence des recherches d'avant-garde effectuées dans le domaine constituent des éléments importants pour un champ orienté vers la science comme celui de la biologie moléculaire.

D'un autre côté, dans le cas des groupes de recherche en télécommunications, orientés vers l'industrie, le mode de professionnalisation comporte des activités de dissémination : création dans l'industrie d'une demande pour la recherche, inclusion de personnel qualifié et de brevets dans le champ de recherche approprié, mise en évidence de la signification des designs, des processus, des instruments et des modèles, etc. Tous représentent des éléments qui caractérisent ce mode spécifique de professionnalisation.

Le document que nous présentons parcourt trois champs en Sciences et Technologie durant la dernière décennie en Inde et établit une relation entre la compréhension de la professionnalisation et le phénomène de la fuite et du gain de cerveaux. De plus, le document tente de dégager quelques implications politiques pertinentes pour les pays en voie de développement.

10- Gain de compétence dans la communauté scientifique mexicaine : une approche alternative

Nora Narvaez-Berthelemot, Angélica María Rosas

La migration des scientifiques des pays en développement vers les pays développés a été l'objet de diverses études. La migration, mais dans la direction opposée, apparaît comme une alternative pour la consolidation du potentiel scientifique d'un pays. Dans la présente étude nous nous proposons d'analyser cet aspect de la migration, en prenant comme base les données du Système national de chercheurs (Sistema Nacional de Investigadores, SIN), du Mexique. Nous analyserons la participation des scientifiques étrangers travaillant en permanence au sein du SIN, leur production et contribution dans le domaine de leur spécialité et leur motivation pour travailler au Mexique de façon permanente. La migration des scientifiques des pays en développement vers les pays développés est considérée comme l'un des indicateurs du niveau de développement d'une communauté scientifique nationale et représente, également, sa capacité d'adaptation et son niveau de créativité. Un pays comme le Mexique, par exemple, a ouvert ses portes aux chercheurs étrangers permanents qui, au lieu de se substituer aux chercheurs nationaux émigrés, ont une part active dans le processus de consolidation de la communauté scientifique nationale.

11- Les voyages scientifiques entre la France et les États-Unis, où est le centre ?

Timothy Carlson, Dominique Martin-Rovet

Chaque année quatre mille jeunes scientifiques français traversent l'Atlantique pour poursuivre aux États-Unis des études du cycle supérieur (« graduate ») et de doctorat, ou encore pour effectuer des séjours post-doctoraux. En sens inverse, pratiquement aucun Américain ne cherche à se rendre en France pour obtenir un diplôme

supérieur et on ne compte qu'environ une centaine d'entre eux qui y occupent un poste de recherche post-doctorale. Ce chiffre peut être approximativement doublé si l'on prend en compte les scientifiques américains qui, à mi-parcours de leur carrière, viennent travailler pour une courte période de temps dans un laboratoire français. À cette situation dans le domaine des sciences s'oppose celle du monde des lettres : c'est, en effet, par vagues entières (environ 3 000) que les étudiants américains de premier cycle (« undergraduate ») arrivent en France pour des études de lettres qui dureront un an ou plus. À ce tableau quelque peu troublant s'ajoute un autre élément déconcertant ; alors que l'Amérique a la réputation bien établie d'accueillir les étudiants étrangers à bras ouverts, c'est, en fait, la France qui en reçoit relativement le plus : il y a en France près de trois fois plus d'étudiants étrangers par rapport à la population estudiantine qu'en Amérique. Et, l'on ne peut pas simplement dire, même s'il y a là une part de vérité, que les scientifiques américains sont réfractaires aux langues étrangères. On ne peut en effet manquer d'observer que, tous séjours à l'étranger pris en compte (y compris ceux dans les pays anglophones), leur mobilité internationale est très faible par rapport à celle des Européens.

Au travers d'enquêtes précédemment publiées (cf. *Bibliographie*) apparaît l'importance de la notion de liberté. Cela nous a donc amené, pour essayer d'expliquer les problèmes dans lesquels se débattent la plupart des scientifiques pour garder leur indépendance, à utiliser la profession scientifique comme cadre de réflexion, à savoir la fourniture, par un spécialiste, de services contre rémunération et privilèges. Une recherche libre est, à bien des égards, moins libre lorsqu'elle devient un service professionnel rétribué. Et il est intéressant de noter que l'on a entendu toujours le même refrain : traverser l'Atlantique a donné au scientifique, d'une façon ou d'une autre, une plus grande liberté dans ses travaux de recherche. De nombreux hommes de science français se sentent plus libres dans leurs travaux de recherche aux États-Unis, et un certain nombre d'Américains éprouvent le même sentiment en France.

Aux concepts de professionnalisation de la science, de carrière, d'indépendance souvent opposés et toujours corrélés à la pression politique que l'environnement social leur impose, viennent s'ajouter les perceptions variées de « centre et périphérie » de la science. Rien n'est vraiment simple et la causalité directe n'aide pas l'analyse. C'est ce que nous essaierons de dégager dans ce travail.

12- Les modalités de la collaboration des scientifiques à l'Université nationale du Mexique

Jane M. Russell, Margarita Almada de Ascencio

L'intégration dans une communauté scientifique globale des scientifiques provenant des pays de la périphérie, particulièrement des pays en voie de développement, est considérée comme un prérequis important pour l'amélioration de la performance de la recherche nationale. Selon certains, l'établissement de contacts avec des collègues venant de pays ayant un haut niveau en recherche permet à un certain point de compenser l'isolement et les déficiences des communautés scientifiques émergentes du Tiers-Monde.

Dans cet exposé nous évaluons la relative importance, en termes de performance de la recherche, des liens qu'ont établis quinze des chercheurs les plus prolifiques de l'Université nationale du Mexique (UNAM) avec des collègues nationaux et internationaux (liens qui s'expriment par le partage des crédits d'auteur et les citations). Les activités de ces chercheurs s'inscrivent dans cinq domaines : la biomédecine, la chimie, la physique, l'astronomie et les sciences de la terre. Les résultats préliminaires de l'étude montrent que la collaboration internationale constitue un élément important dans le développement de la carrière de ces quinze scientifiques. Une analyse de leur trajectoire est en cours et vise à déterminer, d'une part, l'effet du partage des crédits d'auteur sur les modalités de publication des scientifiques de l'UNAM, et d'autre part, les rôles des homologues mexicains et étrangers dans ce contexte.

13- Émigration de scientifiques argentins : le cas du Conicet

Celina Lértora Mendoza

Cette étude a pour but de présenter une image du processus de la « fuite de cerveaux » de Conicet, qui a été créée en 1958 sur le modèle du Conseil scientifique français et dont la finalité a été de créer un groupe national d'excellence scientifique.

Tout au long de sa gestion, le Conicet a vu partiellement échouer ses efforts et ses investissements en formation de personnel hautement qualifié. Ceci est dû à des phénomènes d'émigration. Dans le but d'apporter une solution à ce problème, on tentera de :

1. Tracer un cadre statistique du flux en tenant compte de l'existence des données (les archives de l'institution ne sont pas complètes) ;

2. Déterminer les causes des éloignements, que d'une manière descriptive provisoire seraient dues à : a) des facteurs politiques et économiques étrangers qui exerçaient une certaine pression ; b) des difficultés du système scientifique pour offrir à ses scientifiques des conditions satisfaisantes ; c) aux options offertes et à des changements de mentalité.

À cause de la gravité du phénomène d'émigration des années 1973-1977, entre 1984 et 1986 s'est instaurée, pour la première fois et d'une façon systématique, une politique de rapatriement dont les résultats ont reçu des appréciations différentes. Il n'y a pas de données exhaustives, mais celles que nous avons ont démontré que la réponse des émigrés a été plutôt rare et qu'un pourcentage de ceux qui sont revenus n'a pas réussi à s'établir localement et a émigré à nouveau. Face à cette réalité, on serait bon d'exploiter dans l'avenir les résultats afin d'obtenir une solution que Conicet a déjà commencé à appliquer dans les dernières années. Cette solution a pour but d'établir un flux organisé d'échanges intellectuels entre les chercheurs argentins qui habitent dans le pays et ceux qui travaillent à l'étranger. Dans ce rapport, nous analysons les deux conditions de base qui doivent s'accomplir :

a) une homogénéité suffisante entre les deux communautés ;

b) une expansion sociale de l'intérêt spécifique pour la recherche.

14- La migration des scientifiques au Chili, 1973-1990

Manuel Jiménez

Les causes pour la migration des scientifiques au Chili, pendant cette période, ont été liées à trois facteurs essentiels : premièrement, les bas salaires des scientifiques, surtout dans les universités et les institutions qui rassemblent la plupart des scientifiques au Chili ; deuxièmement, le manque d'équipement sophistiqué dans plusieurs domaines ; et, enfin, des raisons politiques liées au gouvernement militaire.

Traditionnellement, le gouvernement et les universités ont essayé de maintenir sous contrôle cette migration par le biais :

a) de régulations légales et de clauses dans les contrats de travail ;

b) de l'élargissement des installations et de l'amélioration de l'équipement scientifique dans quelques domaines ;

c) du renforcement des contacts des scientifiques chiliens avec leurs pairs autour du monde ;

d) de la valorisation de la recherche par rapport au travail académique ;

e) de la création d'un fonds de financement de la recherche scientifique dans lequel une somme considérable est consacrée à augmenter les salaires des scientifiques.

Pendant la période actuelle, le gouvernement a développé un vaste ensemble d'instruments destinés à maintenir sous contrôle la migration des scientifiques, et, jusqu'à un certain point, il a réussi à réduire le phénomène. De plus, les fondations privées et le gouvernement ont conclu des accords pour instaurer un certain nombre de régulations destinées à inciter les bénéficiaires des programmes à retourner au pays après avoir obtenu leur doctorat.

La principale raison de la migration des personnels hautement qualifiés réside dans la très restreinte capacité de l'université à offrir des postes de travail, spécialement aux jeunes scientifiques, dans le domaine des sciences pures. L'autre employeur potentiel, l'industrie, n'a pas une culture de la recherche, ni dans la science appliquée ni dans la science pure. Par conséquent, l'industrie passe des contrats de recherche avec les universités lorsqu'elle a besoin d'assistance.

L'évolution de l'emploi dans le domaine des sciences sociales, ainsi que le rôle des fondations étrangères pour la recherche sociale, estt extrêmement intéressante. Pendant la période d'étude, le parrainage pour les sciences sociales a augmenté jusqu'à des niveaux jamais connus au Chili, ce qui a pourvu un grand nombre de postes et a contribué à diminuer la migration dans ce secteur.

Grâce à des dispositions administratives et législatives destinées à éviter la migration des scientifiques, un groupe de chercheurs, surtout des chercheurs jeunes et prometteurs, est resté au pays. Ils sont libres d'attache avec le gouvernement ou les institutions. La plupart d'entre eux ont obtenu récemment leur titre de docteur (Ph. D.) Ils ont entrepris leurs études suite à des contacts personnels ou à des contacts avec des institutions nationales ou étrangères. Comme ils n'ont pas des clauses compromissoires avec ces institutions, ils sont libres d'émigrer lorsqu'ils le veulent.

L'autre groupe enclin à migrer rassemble des personnes qui ont une bonne réputation scientifique. Ce groupe a deux sortes de liens à l'étranger : a) une amitié personnel avec des scientifiques de haut niveau à l'étranger ; et b) un bon niveau de contacts avec une équipe de chercheurs avec lesquels ils partagent des intérêts de recherche.

Dans cette étude nous traiterons deux aspects de la migration des scientifiques :

1) le rôle et les effets des restrictions légales et des stimulants conçus pour éviter la migration des scientifiques ;

2) l'évaluation du nombre de scientifiques de haut niveau et des jeunes scientifiques qui ont émigré pendant la période de l'enquête et les raisons qui les ont poussés à le faire.

15- Migration scientifique en Russie au début des années 1990 : ampleur, structure et conséquences

Galina Kitova

1. Dynamiques du personnel en Recherche et Développement et approches de recherche pour étudier la migration des scientifiques

Durant plusieurs décennies, dans l'ancienne URSS et particulièrement en Russie, le nombre de personnes travaillant dans le domaine de la Recherche et Développement a continuellement augmenté. À la fin de la décennie passée, ce taux de croissance s'est ralenti de façon perceptible et au début des années 1990, la diminution du personnel en R & D en Russie a été absolue. Les approches utilisées pour étudier ce processus sont pratiquement demeurées inchangées jusqu'en 1992. Les analyses se sont limitées essentiellement à évaluer le mouvement du personnel en R & D à partir d'indicateurs traditionnels.

Les réformes économiques et politiques en Russie au début des années 1990 ont été initiées dans un contexte global de crise économique et sociale. Cette crise a affecté profondément le domaine de la R & D et a abruptement modifié les traditionnels mécanismes et tendances de développement du personnel en R & D. En 1992, alors que le nombre total de personnes travaillant en R & D en Russie a chuté de 26 %, la dépendance rigide de l'extension et de la structure de cet indicateur (nombre de personnes en R & D) envers les paramètres de la mobilité de personnel (particulièrement les paramètres du départ de personnels du domaine R & D) s'est faite évidente. Aussi, des analystes russes et étrangers ont été amenés à entreprendre des recherches sur les processus propres à la

mobilité du personnel en R & D en Russie. Ils se sont d'abord penchés sur le problème de l'émigration de scientifiques russes et ont alors sonné l'alarme. Cependant, les analyses n'ont pu refléter l'étendue et l'importance réelles de ce problème. En effet, selon les statistiques officielles russes, 426 scientifiques ont émigré dans le but de s'installer de façon permanente à l'étranger au cours de 1993. Mais la perte totale de scientifiques pendant cette année s'est élevée à 17 000 personnes.

2. Ampleur et structure de la perte interne de cerveaux

Entre 1992 et 1995, le départ de personnel du domaine de la R & D a excédé de façon significative l'entrée de personnel dans ce domaine (de trois fois au cours de 1992 et de plus de deux fois durant les années qui suivirent). La distribution de ceux qui ont abandonné les champs de la recherche est variée. La réduction du nombre relatif de chercheurs constitue le changement le plus notable. Cette réduction est en partie explicable par le fait que la crise économique a empêché les chercheurs de trouver de nouveaux emplois qui correspondent à leur niveau d'étude et à leurs compétences.

Le fait que l'exode des personnels auxiliaires et de techniciens est supérieur aux départs des chercheurs peut être expliqué par un « engagement » plus faible de ces deux premières catégories dans la R & D (comparativement à celui des chercheurs). De plus, leurs qualifications, expériences et habiletés leur ont permis de trouver des emplois mieux rémunérés à l'extérieur de ce domaine et de s'adapter rapidement à leur nouvelle occupation.

L'effet négatif de l'exode intensif de ces deux catégories de personnel est clairement apparu à partir de 1993. Il a conduit à la réduction du nombre d'expérimentations dans la science russe, ainsi qu'à la diminution de leur complexité et qualité. Les techniciens et le personnel auxiliaire qui ont poursuivi leurs activités ont graduellement perdu leurs compétences. Et nécessairement la qualité et les résultats de la R & D russe ont été affectés.

Plus de la moitié de ceux qui ont quitté la science entre 1992 et 1995 l'ont fait volontairement. Cela signifie que la réduction du personnel en R & D pendant cette période s'est effectuée spontanément et que le gouvernement n'a pas régulé le processus, son extension et sa structure. Cette conclusion peut être corroborée par le déclin durant cette période de la part relative de licenciements pour compression d'effectif. Selon la législation russe du travail, tout un chacun peut quitter son emploi pour en occuper un autre. Mais la part relative de ces personnes dans le processus d'exode du domaine de la R & D a aussi considérablement diminué.

16- Migrations scientifiques internationales : 25 années de migrations de scientifiques latino-américains en Europe (France, 1970-1995)

Guillermo Lozano

Les migrations des scientifiques latino-américains en Europe ont engendré un potentiel scientifico-technologique qu'il faut identifier à travers l'analyse d'un processus particulier, dans ce cas celui de la migration en France, afin d'optimiser la consolidation des réseaux internationaux. L'établissement des origines, des disciplines et des stratégies d'insertion des chercheurs d'Amérique latine dans la communauté scientifique française permet d'affiner - à travers des processus particuliers - les instruments d'analyse et de compréhension des phénomènes de migrations scientifiques internationales.

En établissant un profil, un ensemble de caractéristiques propres au scientifique latino-américain à l'intérieur de la communauté scientifique française et en identifiant le type de relation avec le pays d'origine, on peut déterminer d'une manière plus précise les stratégies de consolidation des réseaux internationaux de scientifiques de l'Amérique latine et des Caraïbes.

De la même manière, en déterminant quelles ont été les politiques de financement dans la formation de ressources humaines effec-

tuées par la région latino-américaine et celles de la France, au travers de ses programmes de coopération entre 1970-1995, on établit de nouveaux apports dans la conception de politiques de financement pour les activités scientifiques et technologiques.

17- Fuite de cerveaux : problèmes de la migration contractuelle en Russie

Tatyana Kouznetsova

L'émigration des scientifiques (dans le but de suivre une formation, pour voyages d'affaires à long terme ou dans le cadre d'un contrat de travail) est la formule principale du contact international. Elle reflète l'approfondissement du processus de division internationale du travail dans le domaine des Sciences et Technologie. En Russie, ce processus a eu des conséquences particulièrement controversées.

L'émigration des scientifiques ou leur départ à l'étranger dans le cadre d'un contrat de travail à long terme n'est toujours pas une modalité normale d'échange scientifique. Elle présente toutes les caractéristiques d'une fuite de cerveaux unidirectionnelle, problème que confrontent les pays en voie de développement ou vivant une transition économique. En ce sens, les discours qui affirment que les scientifiques russes enrichissent la science mondiale sont en partie exacts.

Le présent document expose quelques résultats d'une recherche menée auprès de dirigeants et de membres du personnel d'instituts académiques et de centres scientifiques d'État. Cette étude met l'emphase sur les scientifiques qui ont travaillé sur des projets internationaux à l'étranger.

Selon les données du Comité d'État des statistiques sur la Russie, au cours de 1993 plus de 65 000 personnes ont émigré de Russie, ce qui représente 20 % de la population ayant fait des études supérieures. Les scientifiques ne constituent pas une large proportion de ces émigrants — 1 % en moyenne. Si cependant on inclut dans cette catégorie d'émigrants le personnel enseignant (dans les cycles supérieurs), les ingénieurs, les dirigeants d'entreprises et les étudiants, alors l'émigration scientifique russe excède les 20 %. Les enquêtes auprès d'institutions scientifiques avec un potentiel considérable d'émigration ont révélé que les autorités respectives ont été conservatrices dans leurs estimations de l'extension de l'émigration. Par leurs analyses de l'importance de ce problème pour la Russie (particulièrement en ce qui a trait au maintien des cursus scientifiques) et du dommage causé par l'émigration dans des champs spécifiques de la recherche, ils soulignent les points fondamentaux suivants :

- la majorité des cas d'émigration sont dûs à des raisons personnelles et familiales, et non à des raisons professionnelles ;

- l'entrée au sein des instituts d'étudiants diplomés mais inexpérimentés aggrave le problème de la continuité scientifique ;

- les scientifiques préfèrent l'émigration dans le cadre d'un contrat de travail à l'émigration directe ;

- de nouvelles opportunités d'auto-réalisation sont en émergence dans les institutions scientifiques en Russie ;

- les scientifiques qui travaillent à l'étranger aspirent à conserver des contacts avec les instituts russes ;

- les effets néfastes sur la science sont beaucoup plus importants suite à la migration interne et à l'érosion de l'activité scientifique causée par le support insuffisant de l'État, la privatisation et autres processus qui ont lieu dans le champ scientifique russe.

L'obtention d'un travail à l'étranger demeure l'un des objectifs les plus attrayants de l'activité professionnelle : c'est l'aspiration de 63 % des personnels de l'Académie russe de la science. Dans certaines institutions, 85 % des scientifiques préfèrent travailler sur bourses et contrats. Les scientifiques ont plusieurs opportunités de participer à des programmes de coopération internationale.

Un travail à l'étranger présente d'indéniables avantages pour les scientifiques ; les avantages matériels revêtent une grande importance mais ils ne sont pas les seuls. La possibilité de mener des recherches dans de bonnes conditions matérielles et techniques et l'accès aux informations scientifiques récentes sont tout aussi importants. Un autre élément moteur a rapport au désir ressenti d'une plus grande indépendance et autosuffisance, et à celui d'avoir de plus grandes opportunités d'obtenir des bourses tant en Russie qu'à l'étranger. Ces motivations peuvent devenir les principales incitations à l'émigration temporaire. Tout cela est lié à l'importance conférée à l'intégration dans la communauté scientifique. Le nom, les références, le statut de l'institution, les projets, la réputation, la participation à des événements internationaux déterminent aujourd'hui les possibilités tant professionnelles que matérielles et les opportunités de promotion au plan professionnel.

Environ 80 % des scientifiques russes ont publié dans des revues étrangères prestigieuses. Les séjours à l'étranger ont permis aux chercheurs d'être mieux informés et d'instaurer des contacts internationaux. Mais il subsiste des obstacles : les publications étrangères sont inaccessibles à la majorité d'entre eux, les mouvements de personnel dans les sciences nationales appauvrissent les recherches locales, les instituts russes n'effectuent pas un suivi de ce que publient leurs chercheurs à l'étranger et ne mènent aucunes analyses sur leurs publications. L'indifférence de la majorité des enquêtés en ce qui a trait à la protection de leurs droits d'auteur de leur production scientifique est préoccupante.

Dans le but d'identifier les problèmes qu'affrontent les scientifiques russes dans leur travail à l'étranger, l'étude analyse les conditions dans lesquelles s'établissent les contacts internationaux entre scientifiques, la nature des ententes entre les personnes et un organisme, les estimations de salaires et de conditions de travail, la présence ou absence de situations conflictuelles, les possibilités de maintenir leur statut, etc. Les problèmes les plus cités ont été : les barrières linguistiques (34,9 %) ; la nécessité d'apprendre à utiliser de nouveaux instruments et de nouvelles techniques (16 %) ; les différences dans les approches scientifiques (11 %) ; l'aliénation (11 %) ; les différences de l'environnement culturel (7 %).

Selon l'opinion des enquêtés, il serait bon que les représentations russes dans des pays étrangers mettent sur pied des associations professionnelles de scientifiques russes vivant à l'extérieur, et ce dans le but de développer des contacts internationaux. Ces associations seraient utiles tant pour les scientifiques eux-mêmes (affirment 58,6 % des personnes) que pour la science russe (52,6 %), et pourraient motiver les scientifiques russes à retourner au pays. Elles pourraient aussi les aider à mieux s'adapter aux conditions de vie et de travail des pays d'accueil, et leur fournir une assistance en ce qui concerne la protection de leurs droits.

18- Transfert inverse de technologie en Afrique subsaharienne : une évaluation préliminaire à partir de données recueillies sur le cas du Zimbabwe

Bernard Ikubolajeh Logan

Le thème du transfert inverse de technologie au niveau humain (« la fuite des cerveaux ») a refait son apparition comme sérieux problème de développement. Pour l'Afrique subsaharienne, c'est un sujet particulièrement problématique à cause de son statut particulièrement bas dans la division internationale du travail. Des données issues des États-Unis et du Canada sont utilisées pour montrer que la région semble perdre un pourcentage plus élevé de ses experts justement quand elle a le plus besoin de leur retour pour atteindre les objectifs du développement. Les principaux éléments du problème sont traités et certaines politiques sont recommandées.

19- Migration des professionnels qualifiés, semi-qualifiés et des techniciens en Afrique du Sud : formes passées, tendances actuelles et politique

David E. Kaplan

Les modèles et causes de la migration de scientifiques vers et dès l'Afrique du Sud sont complexes. Les « attractions », aussi bien que les « répulsions » des scientifiques et techniciens pour travailler en Afrique du Sud ont été déterminées par une série de facteurs économiques et politiques. Ces déterminants n'ont pas été constants, comme on le verra plus tard. Au contraire, ils sont été en train de changer et, jusqu'à un certain point, dépendent des choix politiques.

A titre d'introduction, la première partie de cette étude esquisse brièvement les capacités de l'Afrique du Sud par rapport à la science et à la technologie. Souvent nous mettons en regard ce pays avec les autres pays africains, car, comme nous l'évoquons plus loin, les migrations des scientifiques entre l'Afrique du Sud et le reste du continent africain a pris une importance spéciale. La deuxième partie de ce papier cherche à faire un premier examen des donnés empiriques sur la migration « scientifique » vers et à partir de l'Afrique du Sud. De prime abord, une restriction est à mentionner : les donnés auxquels on se réfère ici ne concernent pas - sauf expressément dit - la migration de « scientifiques », mais celle de la catégorie des « métiers professionnels, semi-professionnels et techniques ». Pour cette catégorie il existe des chiffres, alors qu'il n'en existe pas pour le plus restreint groupe de « scientifiques ».

Cette étude essaie brièvement de faire ce que les historiens appellent une « périodisation », c'est-à-dire, l'identification de longues périodes de temps, séparées par des faits marquants, dans lesquels les facteurs et tendances sous-jacents sont raisonnablement constants. Puis, on examinera les donnés récents - des donnés globaux aussi bien que ceux se centrant dans deux importantes sous-catégories, médecins et ingénieurs. Nous prêtons une attention particulière aux dimensions continentales (l'étendue de l'Afrique) de cette migration aussi bien qu'aux dimensions régionales (les pays de la Conférence pour la coordination du développement en Afrique du Sud, South Africa Development Coordination Conference, SADCC), et au cas du pays clef de la SADCC à cet égard, le Zimbawe.

20- Les migrations de travail des Colombiens hautement qualifiés : l'expérience du réseau Caldas.

Carlos Germán Murcia, Luz Stella Parrado

La plupart des études actuelles autour du flux international du marché du travail sont orientées vers l'observation des effets du marché du travail sur la croissance économique des pays. Ces études se basent sur les supposés du modèle de la concurrence de marchés parfaits néoclassiques.

Néanmoins, la complexité de ce marché a affaibli les principes dudit modèle : l'homogénéité du travail, le salaire comme seule variable d'ajustement entre l'offre et la demande, la symétrie des marchés. De plus, ces principes sont peu déterminants lorsqu'on considère l'analyse des flux des personnes hautement qualifiées, liées à la recherche scientifique et technologique.

Les « défauts anatomiques » de ce modèle deviennent plus évidents lorsque, dans le long terme, présupposant un horizon infini, la théorie est mise en regard avec les études empiriques qui ont des dynamiques de court terme. D'autre part, il est surprenant d'observer comment les mouvements de ce marché sont de plus en plus régulés par des décisions de politique de la part des États, au-delà des résolutions des individus.

De plus, des motivations non monétaires ont renforcé et dynamisé

les décisions sur l'offre et la demande de travail hautement qualifié dans le contexte international, ce qui a fait que l'importance de ces motivations est de plus en plus reconnue.

À partir de ces considérations, nous nous proposons, dans un premier temps, de décrire les limitations des principes qui ont régi quelques études économiques sur les flux internationaux du travail. Dans un deuxième temps, nous ferons appel à une orientation théorique de réseaux sociaux appliquée à l'étude du marché international du travail afin d'expliquer le phénomène des migrations des scientifiques et des ingénieurs. Nous analysons, en particulier, des nouvelles modalités de migration, les motivations et les alliances potentielles de coopération scientifique et technologique établies avec le pays d'origine sans nécessairement entraîner la mobilité des personnes. L'exposé s'appuiera sur l'analyse d'un échantillon de l'enquête « Réseaux Colombie » (« Redes Colombia ») correspondant à l'étude de la diaspora de scientifiques colombiens.

21- La mobilité du capital humain dans la perspective de la science latino-américaine

Vessuri Hebe

Cette étude vise à analyser un ensemble de questions liées à la « balance démographique » de différentes disciplines scientifiques en Amérique latine à partir de la perspective des mouvements de scientifiques dans diverses directions. Il tient compte des arguments passés et présents pour expliquer les flux, en mettant l'accent sur les tendances récentes. En particulier, nous étudions l'argument qui soutient qu'à mesure que les économies de nations individuelles s'imbriquent inextricablement, non seulement les flux de capitaux s'intensifient au point que certains commencent à s'inquiéter de la capacité de l'État-Nation à protéger les intérêts et le bien-être des citoyens, mais aussi le capital humain commence à montrer une volatilité similaire à celle de son pendant fiduciaire.

La globalisation, c'est-à-dire le processus de fusion des marchés nationaux en une version planétaire du Marché, porterait en elle le déplacement inévitable du capital humain au rythme du capital financier. Ainsi, la mobilité du « capital humain » se trouve au cœur de la globalisation. Cependant, non seulement les implications de ce processus globalisateur commencent à changer la façon dont nous voyons notre société respective et la place qui lui correspond dans ce nouveau monde, mais elles imposent aussi une révision de l'image, produite par l'histoire et la sociologie de la science, de la conformation des communautés scientifiques nationales en Amérique latine et de la perception de la « fuite de talents ».

22- La fuite des cerveaux et les nouveaux mécanismes de financement de la science russe

Irina Dezhina

La science russe est en crise à l'heure actuelle. Le processus de « fuite des cerveaux », au niveau interne et externe, en est une illustration. Évaluer l'état réel de la science en Russie signifie observer l'évolution du financement de la Recherche et du Développement (R & D). Le financement fédéral est la principale source de soutien national. Au cours des deux dernières années, de nouvelles formes d'aide fédérale ont fait leur apparition et se développent rapidement, comme les Centres de recherche fédéraux (CRF) et les Programmes fédéraux pour la Science et la Technologie (PFST). Ces institutions ont été présentées par le gouvernement russe comme principales priorités. En tant qu'instruments de la politique scientifique, les PFST jouent un rôle important dans la réalisation des objectifs nationaux. Leurs coûts sont élevés et leurs besoins en financement augmentent plus rapidement que les dépenses totales en R & D. Les institutions et groupes de recherche qui participent à la mise en place de ces programmes jouissent de meilleures conditions financières. Cela influence les conditions sociales et économiques du travail de recherche et, en conséquence, la mobi-

lité du personnel de recherche. De ce point de vue, il y a beaucoup de ressemblances entre les PFST et les CRF. Les Centres fédéraux de recherche font partie des nouvelles institutions les plus intéressantes, car elles apparaissent comme une réaction à l'environnement de transition qui caractérise la société russe. L'idée de base était de préserver les groupes de recherche les plus performants et maintenir les tendances dans la recherche au travers d'un soutien financier additionnel au budget fédéral. Parallèlement, tous les CRF sont profondément impliqués dans la mise en place des Programmes fédéraux pour la Science et la Technologie. Aujourd'hui, on compte 61 centres de ce type, soit environ 1,5 % du nombre total d'organismes scientifiques en Russie. En 1994, ils ont reçu environ 8 % du budget fédéral total alloué à la science.

Pendant la même période, une source de financement de toute importance a refait son apparition : les fondations étrangères accordant des subventions. Depuis qu'elles ont ouvert leurs bureaux en Russie, certaines de ces fondations ont développé des programmes spéciaux pour aider les sciences naturelles, sociales et humaines. En 1994, la contribution de ces fondations pour le soutien de la recherche de base était égale à la part allouée par le gouvernement fédéral dans ces domaines. Ainsi, l'influence sélective des fondations sur le comportement social des scientifiques est considérable.

Un des aspects importants de la politique menée par les fondations étrangères est le financement de la conversion de la recherche militaire. Un des résultats indirects de ce type de programmes consiste en la prévention de la « fuite des cerveaux » travaillant pour la science militaire. À l'heure actuelle, une des initiatives les plus fructueuses en ce qui concerne l'aide à la reconversion est un programme spécial pour les scientifiques et ingénieurs travaillant dans l'armement, programme réalisé par le Centre international pour la science et la technologie (International Science and Technology Center-ISTC). Les projets de l'ISTC sont financés par les États-Unis, l'Union Européenne et le Japon, de même que par la Finlande et la Suède, qui ont joint l'ISTC avant de faire partie de l'Union européenne. Depuis mars 1994, l'ISTC a distribué environ 70 millions de dollars pour financer des projets civils, afin de promouvoir la réorientation de la recherche militaire. Cela représente plus que les dépenses de la Fondation internationale pour la science largement promue par la publicité (plus généralement connue sous l'appellation de fondation Soros) dans le cadre de son programme d'aide à la recherche à long terme pour les sciences naturelles. Aujourd'hui, l'ISTC apporte son soutien à 9 500 chercheurs, ce qui représente environ 14 % de tous les spécialistes qui ont accès à des données secrètes. De même, les fondations étrangères ont influencé la nature des fondations scientifiques russes. En 1993, la première fondation russe, la Fondation russe pour la recherche de base, est entrée en fonction. En 1994, la Fondation russe pour la science a été établie. Celles-ci se voient assignées respectivement 4 % et 0,5 % du budget fédéral pour la science. Ainsi, ces fondations représentent une forme additionnelle de distribution de l'aide fédérale ; parallèlement, elles constituent de nouveaux mécanismes institutionnels et de motivation, et leur impact sur la mobilité dans la communauté scientifique est très significatif. Dans ce projet de recherche, l'analyse du processus de « fuite des cerveaux » est présentée dans un contexte comparativement large, dans la mesure où il dépend des changements financiers et institutionnels de la science russe. L'accent est mis sur l'analyse des stratégies financières développées par les chercheurs en tant qu'individus et par les institutions de R & D : la détermination de l'influence de nouvelles sources d'aide pour les projets de survie des institutions, des groupes scientifiques et des boursiers. L'analyse couvre différents types de mobilité scientifique : l'émigration à l'étranger ou vers d'autres secteurs d'activité de l'économie à l'intérieur du pays ; le travail à contrat dans des pays étrangers ; de même qu'un phénomène relativement récent, ladite « migration de l'information », lorsque les scientifiques russes préfèrent publier les résultats de

leur recherche dans des revues étrangères. L'évaluation de l'impact des fondations non russes sur la mobilité scientifique attire tout spécialement notre attention dans ce projet. Elle contribue à la compréhension de l'efficacité de la participation étrangère dans la science russe. Cette interrogation est d'un intérêt vital à la fois pour la communauté russe et internationale. Les effets indirects de l'activité de ces fondations sont des plus intéressants : leur influence sur le climat social dans la communauté scientifique, sur la formation et le statut social des nouvelles générations de boursiers, sur la « fuite des cerveaux », interne et externe. Nous attirons particulièrement l'attention sur la science militaire et les problèmes de conversion. Les docteurs en science militaire ont un comportement social spécifique, aussi la réduction de la « fuite des cerveaux » dans ce secteur est une entreprise distincte et spéciale ; nous avons pris ici l'exemple de l'ISTC.

L'objectif final de cette étude est de comprendre quelles structures sont les plus efficaces pour limiter la « fuite des cerveaux » et identifier les meilleurs mécanismes de régulation de ce phénomène. Cette recherche commence à peine. Les premiers résultats sont la mesure de l'impact des fondations étrangères sur la mobilité dans la recherche.

23- Émigration : effets sur la structuration du champ scientifique algérien

Hocine Khelfaoui

Après une brève présentation du contexte national et international de cette émigration, cet exposé tente d'en évaluer l'impact sur la structuration du champ scientifique algérien.

La première traitera de l'effet de la migration sur les deux principales institutions utilisatrices de savoir, l'université et l'entreprise. Paradoxalement, l'émigration des scientifiques s'est intensifiée au moment où l'université et l'entreprise, ayant achevé leur phase fondatrice, commencent à exprimer des besoins en Recherche et Développement.

La seconde partie traite de l'impact sur la constitution d'une science locale. L'analyse porte sur l'effet du mouvement migratoire - départ et retour - sur le processus d'accumulation scientifique et technique. Deux aspects sont évoqués : l'interaction entre pluralité de logiques scientifiques nationales (affrontement d'écoles) et les situations de dépendance-autonomie qui en résultent.

24- Migration des scientifiques et stratégies de réinsertion

Pablo Kreimer

Lorsqu'on formule de façon problématique le sujet de migrations des scientifiques en Amérique latine, il est nécessaire de faire une référence au processus qui a eu lieu, vers les années 1960 et 1970, caractérisé par un exode massif de chercheurs, spécialement vers les États-Unis et l'Europe de l'Ouest. Dans un premier temps, ce processus a deux causes : l'engagement politique d'une bonne partie des chercheurs, et les politiques répressives des gouvernements autoritaires des militaires. Il est vrai que ce ne sont pas les seules raisons qui expliquent cet exode. Néanmoins, l'image du « drainage » des cerveaux (*brain drain*) par laquelle on a connu ce processus à l'époque synthétise bien le climat du temps, particulièrement dans les pays où, comme en Argentine, les gouvernements militaires ont exercé une répression spéciale envers tous les intellectuels. Incidemment, une des conséquences de cette émigration massive de chercheurs a été de produire une rupture partielle des traditions existantes dans le domaine des méthodes de recherche scientifique, lesquelles doivent être comprises, surtout, comme le produit social résultant des interactions entre générations.

Vers la décennie de 1990, après l'arrivée de la vague de restauration des démocraties qui a eu lieu dans la décennie précédente,

les processus des migrations semblent s'être normalisés, dans le sens que des pratiques similaires à celles de certains des pays les plus développés ont été adoptées un peu partout. Ainsi, un pourcentage important de jeunes chercheurs prépare un doctorat et post-doctorat dans des centres académiques d'Europe de l'Ouest et des États-Unis. Il est vrai que, normalement, une partie de ces scientifiques s'établit, de façon définitive, dans ces institutions.

Toutefois, ce qui nous intéresse ici, c'est le processus qui a lieu au retour dans le pays d'origine : les stratégies déployées pour atteindre la réinsertion, l'élection de thèmes de recherche (et la relation de ceux-ci avec les sujets que les expatriés travaillaient dans les institutions à l'étranger), la structuration d'un réseau de liens (internes et externes), le rapport entre les sujets de recherche et des problèmes d'application de la recherche, des stratégies pour l'obtention de ressources, des façons d'organiser la recherche, etc. Pour illustrer ces problèmes, nous ferons référence dans cet exposé à une recherche développée dans plusieurs laboratoires argentins, que nous présenterons comme des cas d'espèces.

25- L'expérience du Pedeciba comme point d'inflexion dans les migrations scientifiques de la communauté uruguayenne en sciences fondamentales

Adriana Barreiro Díaz, Léa Velho

En Uruguay, la création du « Programme de développement des sciences fondamentales » (Pedeciba) a permis, à la fin des années 1980, le retour d'un grand nombre de chercheurs en sciences fondamentales qui, pour divers motifs et intérêts, avaient émigré durant la décennie 1970.

Malgré les persécutions du régime militaire dans le pays (1973-1985), les possibilités limitées et les conditions difficiles qui affectent les institutions scientifiques (centrées sur l'Université de la République et deux centres de recherche contrôlés par l'État), on a pu observer que même si une grande partie des scientifiques émigre, plusieurs demeurent et continuent à déployer leurs activités dans le pays. Cependant, grâce aux efforts consécutifs à la mise en œuvre du Pedeciba, tant ceux qui sont partis et se sont vus soumettre à l'éthos scientifique d'une communauté d'accueil, que ceux qui ont choisi de rester au pays, ont fini par se joindre à ceux qui se sont formés à l'étranger.

Compte tenu :

a) des indices d'émigration des scientifiques (entre 1970 et 1980, 280 000 personnes soit 10 % de la population totale du pays),

b) des particularités inhérentes aux contacts constants et à la communication intra- et inter-groupes,

c) du désir de beaucoup d'entre eux de revenir au pays et contribuer au développement de la science locale,

d) de l'intérêt manifeste à consolider des équipes de recherche et atteindre une certaine « masse critique » dans chacun des champs du Programme (biologie, physique, informatique, mathématique et chimie),

e) et, fondamentalement, de l'intérêt à utiliser les rapatriés comme piliers de la formation de ressources humaines - via la mise en place des premiers programmes de maîtrise et doctorat en sciences fondamentales -,

les activités du Pedeciba, appuyées par plusieurs organismes internationaux (CEE, Pnud, Unesco), par l'Université de la République et des nouvelles autorités démocratiques, ont facilité une « migration inversée » qui, aujourd'hui, contribue à une nouvelle histoire des sciences fondamentales et à une migration renouvelée et critique (de type « étudiant ») des jeunes scientifiques uruguayens. Le départ et le retour des formateurs suscitent un questionnement chez plusieurs étudiants.

26- Modèles de migration des universitaires de la Chine

Shaoni Tang, Paul Robins

Cet article décrit une enquête conçue en vue d'identifier des moyens pour améliorer le taux de retour des Chinois boursiers étudiant à l'étranger. La principale optique de cette étude concerne les étudiants boursiers du gouvernement et des universités chinois.

Au cours des 16 dernières années, la Chine a introduit des réformes afin de s'ouvrir vers le monde extérieur. Durant cette période, 220 000 étudiants ont été envoyés à l'étranger pour compléter leurs études ou effectuer des stages. 120 000 ont été aidés par le gouvernement et les universités chinois. La majorité d'entre eux est allée aux États-Unis et au Canada ; un plus petit nombre, au Japon, en Allemagne, au Royaume-Uni, en France, en Australie et en Nouvelle-Zélande.

Le programme de doctorat est une des nombreuses initiatives chinoises visant à apporter à la Chine expertise et connaissances dans la science de pointe, pour promouvoir la transformation et l'amélioration du système éducatif, dans la mouvance de sa réforme politique et économique. Il a été conçu comme une part importante du processus de modernisation de l'économie chinoise, particulièrement dans le cadre du développement scientifique et technologique.

Cependant, cette contribution potentielle a été dans la pratique, limitée du fait d'un retour reporté par de nombreux étudiants. Entre 1979 et 1993, 43,3 % des étudiants boursiers (pourcentage estimé) ne sont pas retournés après une absence prolongée.

Cette étude a été entreprise pour développer la connaissance et la compréhension du phénomène afin de permettre aux organismes accordant une aide financière de mieux sélectionner et gérer les bourses d'études à l'étranger (quant à la rapidité du retour). L'étude comporte deux parties : la première est une analyse du comportement passé des étudiants et docteurs (un échantillon de 2 035 personnes issues de quatre universités chinoises) ; la seconde est une étude par questionnaire des motivations exprimées par les étudiants chinois à l'étranger (au Royaume-Uni). Les relations entre le taux de retour et l'âge, la durée du programme, le pays d'accueil et l'organisme d'aide ont été étudiées. L'enquête de motivation a été entreprise pour permettre d'identifier les raisons qui ont influencé le taux de retour des étudiants boursiers (sous la contrainte des contrats). Une analyse préliminaire suggère que tout changement qui pourrait être effectué pour encourager un retour rapide serait tel qu'il encouragerait également la migration interne.

La conclusion de cet exposé reflète les buts de cette étude et illustre la valeur pour la Chine de son programme d'échange d'étudiants boursiers.

27- Inversion de la fuite des cerveaux à Hong Kong ?

Wenhui Zhong

Au cours d'entretiens que j'ai effectués durant la période de Noël 1994 pour un programme de la « BBC World Service » sur les personnes qui retournent à Hong Kong, je me suis aperçu que les étudiants chinois à l'étranger revenaient de plus en plus souvent à Hong Kong pour travailler. Après l'exode des Chinois de Hong Kong vers les pays de l'Ouest à la fin des années 1980, le modèle de migration s'est inversé. Parmi les personnes qui reviennent et qui détiennent des passeports étrangers, un nombre significatif est constitué par ceux qui sont allés dans les pays de l'Ouest en tant qu'étudiants depuis la Chine et qui représentent des entreprises multinationales de Hong Kong en vue d'exploiter le marché chinois.

Ces professionnels possédant des passeports étrangers représentent environ 60 000 personnes au sein d'une population totale comprenant 6 millions d'habitants à Hong Kong. Ils constituent une force d'importance pour maintenir la réputation de première catégorie de Hong Kong au titre de centre financier international et de lieu de rencontre entre l'Est et l'Ouest.

Plusieurs des personnes interrogées font preuve d'un optimisme réservé quant à l'avenir de Hong Kong. Ils témoignent d'une certaine ambivalence quant à leur identité, soit chinoise, soit celle de leur société d'adoption. Ils se préoccupent peu de leur appartenance à un lieu donné dans la mesure où ils peuvent exercer leur profession. Les autres thèmes abordés dans cette étude sont les relations inter-raciales, l'adaptation au choc culturel et les problèmes des familles séparées.

28- La perspective du « va et vient » comme alternative à la perspective de la fuite des cerveaux Exemples chinois

Paul Pedersen, Ko Shan Lee

Dans la présente contribution, nous exposons les modèles de prise de décision de retourner au pays à l'issue d'études à l'étranger. L'analyse s'appuie sur des données qualitatives et quantitatives obtenues auprès d'étudiants de Taïwan qui ont mené des études aux États-Unis en sciences et en ingénierie.

Nous passons en revue la littérature existante sur les processus de retour et présentons des exemples de cas, enfin nous émettons quelques suggestions pouvant servir de base à de futures études sur cette problématique.

29- Inversion de la fuite des cerveaux en Corée de la décennie 1960 à la décennie 1980

Ha-Zoong Song

La « fuite des cerveaux » et l'éventuelle inversion de cette tendance constituent un phénomène significatif dans le monde, avec de profondes implications pour le développement des diverses nations et la distribution géographique du flux de l'innovation technologique. Au cours de la controverse sur la « fuite des cerveaux » dans les années 1960, certains analystes ont cru que des « stimulants » économiques ou sociaux conduiraient les gens talentueux des pays en voie de développement à migrer vers les pays avancés. Vu les ressources dont disposaient alors les pays en voie de développement, il semblait improbable que ce problème soit résolu rapidement. Aujourd'hui, beaucoup de pays du Tiers Monde perdent encore leurs meilleurs talents à l'avantage des pays avancés. Au cours des dernières années, cependant, on a pu observer de manière notable une augmentation du nombre de Coréens qui retournent dans leur pays après avoir étudié aux États-Unis. En fait, les deux tiers des Coréens qui ont obtenu au cours des années 1980 un doctorat en sciences naturelles ou en ingénierie d'institutions américaines sont revenus en Corée dans les trois années qui ont suivi l'obtention de leur diplôme. Taïwan a connu un même mouvement d'expatriés rentrant au pays. La « fuite traditionnelle des cerveaux » et le retour inattendu d'expatriés de long terme (l'inversion de la tendance « fuite des cerveaux ») posent des problèmes politiques complexes pour des nations comme la Corée ou Taïwan. En tant que pays pauvre en ressources naturelles, la Corée cherche un retour en investissement de la part de ses habitants afin de maintenir son rythme de progrès.

Pour voir quelles sont les implications en termes de politique de la « fuite des cerveaux » et du rapatriement des scientifiques et ingénieurs coréens, j'ai recueilli mes informations auprès de deux groupes de scientifiques et d'ingénieurs coréens (432 aux États-Unis et 406 en Corée), à l'aide d'un questionnaire présenté sous forme de « mailing » et d'entretiens personnels. Tandis que l'enquête fournit des informations sur la situation familiale, le travail et la carrière au niveau individuel des scientifiques et ingénieurs coréens, ainsi que sur leurs perceptions et attitudes, les indicateurs de la situation extérieure en Amérique et en Corée ont été tirés de statistiques extraites de publications. J'ai analysé cette information en adoptant plusieurs approches complémentaires.

1) Comparaison descriptive entre les scientifiques et ingénieurs coréens qui reviennent en Corée et ceux qui sont restés aux États-Unis.

2) Analyse de la différence observée entre intention et action de la part des scientifiques et ingénieurs coréens au niveau individuel.
3) Effet et contribution de chaque facteur de décision sur le choix du lieu de résidence à partir d'une analyse discrétionnaire des choix.

Les résultats de mes observations sont les suivants : bien que les conditions économiques exercent une influence critique sur la tendance indiquée par le taux de retour, l'effet de facteurs intangibles issus des différences culturelles existant entre les deux pays est devenu plus apparent au fur et à mesure que l'économie coréenne s'est améliorée au cours de ces dernières années. Lorsque la différence de conditions économiques entre les alternatives se voit diminuer, les facteurs psychologiques et émotionnels sont reconnus comme étant importants. En particulier, l'analyse suggère que les valeurs confucéennes jouent comme un élément justifiant les décisions des scientifiques et ingénieurs coréens. Par exemple, on peut noter que le prestige lié aux emplois dans l'enseignement est un facteur majeur affectant les décisions des scientifiques et ingénieurs coréens. Parce que l'enseignement a traditionnellement été une occupation d'une élite instruite, les emplois liés à cette fonction véhiculent un très haut degré de prestige à l'intérieur de la société coréenne structurée par les valeurs hiérarchiques de Confucius. De plus, le fait que les scientifiques et ingénieurs coréens aient de grandes responsabilités envers leur famille, que ce soit en Corée ou en Amérique, constitue un autre facteur critique dans la prise de décision. En conséquence, cette étude illustre l'importance des facteurs culturels dans la formulation des politiques qui concernent les thèmes de la « fuite des cerveaux ».

30- Experts tunisiens à l'étranger : une plus grande contribution au développement national

Henchi Belgacem

Depuis son indépendance en 1956, la Tunisie a encouragé la scolarisation qui est devenue obligatoire depuis 1990. Cependant l'infrastructure de la formation universitaire ne s'est pas développée à la même vitesse que l'école primaire et secondaire, surtout dans le domaine des technologies de pointe. Cette situation a conduit l'État pendant longtemps à envoyer les étudiants les plus brillants à l'étranger (Europe et États d'Amérique) soit pour une formation universitaire soit pour une spécialisation plus poussée (DEA, thèse, stage de formation spécialisée...). Plusieurs de ces lauréats sont restés dans les pays d'accueil pour de multiples raisons. Leur nombre est assez élevé ; ils sont essentiellement en France, Canada et États-Unis. Parallèlement, un certain nombre de scientifiques tunisiens en place et de renommée internationale sont drainés par des offres alléchantes vers des laboratoires européens, américains (États-Unis, Canada) et des universités des pays du Golfe.
Consciente de cette fuite de compétences, la Tunisie, depuis le changement de 1987, a pris une série de mesures visant la limitation de nouvelles fuites de cerveau, le rapatriement de compétences tunisiennes à l'étranger lorsque cela est possible et la collaboration scientifique avec ceux qui souhaitent rester dans les pays d'accueil.

31- Migration de scientifiques : le cas uruguayen

Adela Pellegrino, Wanda Cabella

Nous proposons de considérer le thème de l´émigration des personnes hautement qualifiées, en particulier des scientifiques, à travers les transformations que subit le monde contemporain.

Dans cet exposé nous abordons ce thème sous deux aspects :

- premièrement, l´état des lieux dans la littérature sur la migration en Amérique latine ;
- deuxièmement, le cas de l´Uruguay - un des plus petits pays d'Amérique latine - dans ce contexte, alors que la recherche sur ce problème présente un considérable retard.

32- Migrations de scientifiques, réseaux de coopération et développement en Amérique latine et dans les Caraïbes

Guillermo Cardoza, Raimundo Villegas

Les pays de l'Amérique latine se sont engagés dans la restructuration de leurs économies dans le but de surmonter la crise qui les a maintenus dans la stagnation économique et sociale depuis le début des années 1980. Les processus en cours d'ouverture et de libéralisation des marchés requièrent qu'on conçoive et mette en pratique des politiques technologiques destinées à la création et consolidation d'une capacité d'innovation qui supporte les augmentations de productivité et de compétitivité nécessaires pour participer des courants les plus dynamiques du commerce international. Pour mener à bien cette complexe tâche, on a besoin, outre de politiques bien définies et de ressources financières, de ressources humaines hautement qualifiées. Toutefois, les efforts importants entrepris dans la formation des ressources humaines dans la région sont en train d'être sérieusement menacés par l'accroissement des flux migratoires des scientifiques, ingénieurs et professionnels vers les pays industrialisés.

Il y a quelques années les analyses des migrations de personnel hautement qualifié dès pays en développement vers les pays développés se centraient dans la détermination des causes et motivations de la migration (un phénomène qu'on a connu comme « fugue de cerveaux », *brain drain*) et dans la conception de politiques de rapatriement pour la contrecarrer. Dans ces études on essayait de diagnostiquer et quantifier la dimension des flux migratoires et leur impact économique et social. Aujourd'hui cette approche reste encore prévalante dans les analyses. Néanmoins, les nouvelles technologies de télécommunication, particulièrement celles des réseaux télématiques, permettent de poser le problème à partir d'une perspective différente, dans laquelle on met l'accent sur la possibilité de transformer l'émigration en une « récupération de cerveaux » (« brain gain ») moyennant la coopération que peuvent prêter les talents émigrés.

Dans cette étude, nous insistons sur les possibilités de coopération offertes par la participation des émigrés et on essaie de fournir des éléments de réponse aux questions suivantes : Comment peuvent les pays en développement recevoir de l'appui de la part de leurs scientifiques, ingénieurs et autres professionnels émigrés vers les pays développés ? Quels sont les éléments qui doivent être considérés dans la conception et l'application des politiques gouvernementales et dans les stratégiques corporatives visant l'engagement des émigrés ? Quelles structures peuvent garantir l'utilisation optimale de la coopération fournie par les ressources humaines émigrées et quel est le rôle que doivent jouer les gouvernements dans la construction de ces structures ?

Pour atteindre ces objectifs, nous avons procédé par paliers : dans la première partie est étudié le phénomène des migrations dans le contexte des processus de « globalisation excluante » qui caractérisent les transformations en cours de l'économie mondiale ; une brève synthèse relève les aspects fondamentaux abordés dans divers travaux sur les migrations. Dans la deuxième partie, après avoir analysé brièvement l'impact de ces migrations sur le développement régional, nous préconisons la construction de la Communauté scientifique globale de l'Amérique latine et de la Caraïbe à travers la création de Réseaux globaux de coopération pour l'innovation qui incorporent à la nouvelle stratégie de développement régional les ressources humaines qualifiées résidant et à l'extérieur et au sein de la région. Nous évaluons l'utilité de ces réseaux comme mécanisme de transfert des connaissances dans le processus d'« apprendre à innover ». Ensuite, nous analysons des réseaux en soulignant leurs caractéristiques et avantages, leur structure et morphologie, ainsi que le rôle joué par l'État dans leur encouragement et utilisation au profit du développement.

Enfin, nous présentons brièvement le projet « Base de données de chercheurs et professionnels de l'Amérique latine et de la Caraïbe résidant en dehors de la région ». Ce projet a été réalisé conjointement par l'Académie de sciences d'Amérique latine (Acal), l'Association latino-américaine de scientifiques (Alas) et l'Unesco.

Son but est la création d'un Fonds régional pour la coopération scientifique, visant l'encouragement de la coopération entre chercheurs résidant dans la région et entre ceux-ci et leurs collègues émigrés vers les pays développés.

33- « En contact avec le Venezuela » Conicit : conception de la gestion et évaluation de politiques

Iván de la Vega

Le Conseil national de recherches scientifiques et technologiques (Conocit) a monté un projet appelé « En contact avec le Venezuela », lequel cherche à mettre en contact les professionnels vénézuéliens résidant à l'étranger avec les différents acteurs du Système national d'innovation, en utilisant la plate-forme de communications du Réseau académique de centres de recherche et d'universités nationales (Reacciun). Parallèlement, le Conseil propose une stratégie de prévention à l'émigration potentielle des étudiants et professionnels en formation. Il favorise les stratégies de retour, par le biais du suivi des possibilités et conditions tant du pays que du postulant. Cette stratégie est étroitement liée à l'information détenue sur le potentiel scientifique et technologique vénézuélien.

Nous coordonnons ce projet qui s'inscrit dans le cadre de la Direction générale des politiques et des stratégies du Conocit.

34- La dialectique du virtuel et du concret dans les « nœuds » de Caldas, le réseau de chercheurs colombiens expatriés

Bernard Schlemmer, Jacques Gaillard,
Dora Bernal, Nora Narvaez-Berthelemot

Le réseau Caldas est connu comme un réseau électronique regroupant, grâce a Internet, les chercheurs colombiens expatriés. L'idée est de créer - ou de recréer - ainsi une communauté scientifique nationale, malgré la grande dispersion géographique de celle-ci.

Mais cette communauté ne peut, bien entendu, prendre corps que si ses membres « jouent le jeu », c'est-à-dire s'ils se sentent autant membres de la communauté nationale d'origine qu'ils se sentent membres de la communauté scientifique internationale, et savent se mobiliser en conséquence.

Or, pour des personnes ayant quitté la Colombie depuis parfois longtemps, une identification avec des enjeux relatifs au développement national n'est pas automatique et immédiate. Il y a un important travail d'intéressement pour mobiliser cette population volatile dans une œuvre collective. Le réseau est maintenant constitué de 21 « nœuds », associations locales d'intellectuels colombiens ou colombianistes dans les pays de résidence, dotées d'une personnalité juridique, ou en passe de l'être. Chaque nœud local possède ses caractéristiques propres, dues à l'histoire de sa constitution, à la population de sa diaspora, etc. Le nœud suisse, par exemple, est l'un des plus dynamiques pour la mise en œuvre de projets scientifiques internationaux liant chercheurs colombiens travaillant dans des laboratoires helvétiques, chercheurs colombiens restés au pays et chercheurs étrangers, suisses ou non, mais il reste très centré sur les sciences « dures » : les sciences humaines n'y trouvent guère leur place, et moins encore ceux pour qui la recherche scientifique représente un centre d'intérêt, mais qui ne font pas profession de chercheurs. À l'inverse, le nœud new-yorkais compte une forte proportion de Colombiens qui ne sont pas des chercheurs, mais des artistes, des littéraires, des professions libérales, etc., et ne développe pas seulement des échanges scientifiques, mais toutes sortes d'activités sociales et culturelles.

Le nœud français se situerait entre ces deux extrêmes, avec une importante représentation de chercheurs en sciences sociales... Mais au prix de tensions certaines avec les chercheurs en sciences exactes : ceux-ci ont l'impression que le nœud y perd son âme, sa spécificité et - du point de vue des retombées qu'ils en attendaient personnellement - son intérêt... Au point même que certains ont quitté l'association. Certains nœuds font preuve d'une concentration dans un domaine particulier comme les sciences médicales

pour le nœud suédois à Stockholm dont la majorité des membres est active au sein du prestigieux institut Karolinska.

Une telle diversité des nœuds est sans doute signe de vitalité, mais révèle également la contradiction interne du projet : le modèle repose à la fois sur le postulat d'une science universelle - il faut donc laisser les chercheurs colombiens dans les laboratoires du Nord - et sur le patriotisme de ces chercheurs : ils doivent se sentir colombiens, se mobiliser, militer, pour que le réseau fonctionne. Or, plus ils se considéreront comme des scientifiques, plus ils voudront faire du réseau Caldas un réseau scientifique international, privilégiant l'échange avec leurs pairs, et sans trop se préoccuper des retombées sur les collègues un peu trop hors de leur champ, sous prétexte qu'ils seraient colombiens : la science n'a pas de frontière. À l'inverse, plus ils se sentiront colombiens, plus ils céderont à la tentation de transformer le réseau en un réseau d'échange et d'entraide, diluant son potentiel strictement scientifique - et perdant leurs collègues qui se situent plutôt dans le premier cas de figure.

On assiste ainsi à un décalage certain entre le modèle de réseau dominant dans le discours officiel sur Caldas - ou le discours qui s'attache à lui sur le seul plan du réseau électronique - et le modèle réellement mis en œuvre par la plupart de ses membres, même ceux qui se considèrent comme membres actifs. Dans le modèle théorique, grâce au réseau électronique, le monde de la science est devenu un village, la distance est abolie et chacun peut dialoguer en voisin avec chacun. Dans les faits, le monde est peut-être un village, mais il faut alors admettre que peu de monde se retrouve sur la grand-place, le forum : le dialogue se limite souvent à la maison familiale, dont les volets sont sans doute entrouverts, mais dont la porte est close. Ceux qui se servent du courrier électronique, d'ailleurs, s'en servent bien plus souvent pour maintenir des contacts avec la Colombie que pour ouvrir le dialogue avec d'autres chercheurs d'autres pays : la structure des communications des chercheurs colombiens expatriés appartenant à Caldas ne ressemble pas à une toile d'araignée aux connexions multiples, mais à une étoile ayant la Colombie pour centre.

Nous développerons ces observations en nous appuyant sur les cas des nœuds étudiés en Autriche, Belgique, États-Unis d'Amérique, France, Mexique, Suède et Suisse.

35- Potentialités et limitations du réseau Caldas des chercheurs colombiens à l'étranger : les projets internationaux conjoints

José Granés, Alvaro Morales, Jean-Baptiste Meyer

Le réseau Caldas de chercheurs et ingénieurs colombiens à l'étranger constitue une proposition innovatrice de politique scientifique conçue dans le but explicite de lier les scientifiques expatriés au développement de la science dans leur pays. À travers le réseau, diverses modalités de liaison et coopération ont été mises en pratique, parmi lesquelles on peut signaler l'évaluation de projets de recherche conçus en Colombie, l'échange d'information et de services, des stages pendant des périodes de temps limitées, la participation à des séminaires et à des événements d'autres types, des assessorats et, enfin, la conception et le développement de projets conjoints de recherche. Cette dernière modalité de coopération est, sans aucun doute, celle qui, dans le long terme, peut avoir l'impact le plus fort sur le développement de la science en Colombie. En effet, la mise en place de projets conjoints au niveau international peut signifier pour le pays un transfert significatif de culture scientifique, ainsi qu'une construction de liens stables avec des centres scientifiques et technologiques au niveau international.

Au sein du réseau Caldas on a commencé, avec un succès variable, divers essais d'élaboration de projets conjoints. L'examen de quelques-unes de ces initiatives peut mettre en lumière les potentialités, ainsi que les limites du réseau. Il peut aussi aider à éclaircir les formes d'opération et les mécanismes qui devront être mis en place pour motiver et convaincre différents acteurs, négocier avec eux et démarrer ce type de projets.

Nous examinerons, dans cet exposé, trois essais d'élaboration de projets conjoints à travers le réseau : un projet multilatéral, dénommé « projet BIO-2000 », qui compte avec la participation de chercheurs de différents pays européens et latino-américains ; un projet de transfert de technologie dans le domaine de la robotique, dont la première étape est déjà finie ; et un projet qui n'a pas pu se concrétiser, entre un institut colombien de recherche pour la santé et un institut homologue en Suède. Dans chaque cas, nous essayerons d'élucider le rôle joué par l'encore faible tissu de relations en processus de consolidation à travers le réseau Caldas.

36- De ma migration à la créativité dans le réseau Caldas : approximations psychanalytiques

Beatriz Mirámon Archila

La migration peut être assimilée à un « situation traumatique », avec les altérations psychopathologiques qui s'y rattachent. Le traumatisme vient de la suppression subite des habitudes vis-à-vis du monde extérieur. Dans le monde intérieur du migrant, la perte d'identité prédomine : dans la plupart des cas on observe la disparition des particularités individuelles, familiales et communautaires qui la composent.

La créativité, dans ces cas, est le résultat de la manière dont le sujet réussit à transformer les situations de confusion, de chaos et de perturbation mentale, en des facteurs favorables à son développement. Cela constitue un paradoxe puisque la situation de conflit peut mener à un affrontement avec le développement de la créativité entendue comme un des éléments stimulants. En des termes psychoanalytiques, il s'agirait de l'éventualité de mettre en place un deuil qui permette au sujet de réaliser une nouvelle réorganisation psychique.

Étant connues les difficultés du processus migratoire et les possibilités créatives qu'il suscite par le biais de la reconstruction d'une nouvelle identité à l'étranger, son étude pourrait enrichir l'observation des migrations et même contribuer aux actions de prévention et d'aide dans des situations douloureuses, particulièrement lorsque la résolution est négative et risque d'affecter gravement le psychisme.

Il serait intéressant de discuter les idées de cette recherche sur la base des objectifs de la Red Caldas (Réseau colombien des chercheurs et ingénieurs à l'extérieur), en approfondissant dans quelle mesure celle-ci facilite ou enrichit le processus.

37- La technologie de l'information comme mécanisme de recherche pour la récupération des compétences

Greta Pifat, Virginia Cano

La présente contribution étudie le recours à la technologie de l'information pour développer et maintenir une base de données sur les scientifiques « migrants ». Elle concerne plus spécifiquement l'utilisation des services liés à Internet, comme les listes de présentation pour identifier et contacter les scientifiques qui ont migré des pays en voie de développement vers les pays industrialisés du Nord, et qui souhaitent maintenir ou renouveler le contact avec leur pays d'origine. Cette étude explore certains aspects méthodologiques d'Internet dans le cadre de la recherche de scientifiques et souligne l'intérêt du recours aux technologies du « mailing » électronique pour constituer et maintenir à jour une base de données de scientifiques qui soit facilement consultable.

Les auteurs se sont intéressées à la Croatie, cas exemplaire des conditions qui conduisent à la migration des scientifiques ; elles donnent d'amples détails sur les efforts de diverses personnes pour maintenir le contact avec les communautés dont elles sont issues et montrent comment une telle base de données pourrait être mise en œuvre pour le bénéfice des scientifiques migrants, des législateurs en matière de sciences et des jeunes scientifiques restés au pays.

38- Internet et la globalisation de la communauté scientifique nationale : une étude empirique

Jean Baptiste Meyer, José Granés

La Colombie est le premier pays qui a mis au point « l'option diaspora » par laquelle les scientifiques et les ingénieurs expatriés autour du monde sont mis en rapport avec leurs collègues restés au pays, par le biais du dénommé « réseau Caldas ». Un des instruments les plus importants de ce réseau est une liste électronique à laquelle la plupart des participants sont liés. Dès l'origine, la liste sert d'espace constitutif aussi bien que d'instrument collectif d'animation pour la communauté nationale et globale dans son processus de construction. Notre travail présente des résultats d'une étude de quatre années sur le réseau Caldas et sur les trois années d'activité de sa communication électronique, depuis janvier 1993 jusqu'à décembre 1995.

Trois points sont développés :

1) Les développements conjoints du réseau et de la liste à travers leur histoire ;

2) une analyse statistique de 1 027 messages échangés pendant les trois années de la période (traités par une base de donnés) ;

3) une évaluation de l'effet réel qu'a la communication électronique sur l'extension de la communauté nationale au-delà de ses frontières.

Les résultats empiriques de l'étude sont abondants. Parfois ils confirment quelques présomptions sur des nouvelles tendances générées par Internet. Mais quelquefois des suppositions sont aussi contredites. Ces résultats permettent de dégager des considérations fondamentales sur le phénomène Internet en science et technologie.

39- Perspectives d'analyse statistique dans l'étude des migrations scientifiques et professionnelles

Alvaro Montenegro

Nous traitons ici les stratégies, techniques et outils utilisés dans l'enquête « Réseaux Colombia » (« Redes Colombia »), réalisée comme partie du projet « La 'fuite des cerveaux' reconsidérée à travers le cas colombien. Étude du Réseau Caldas ». (« El 'Brain Drain revisited' a través del Caso Colombiano. Estudio de la Red Caldas »). L'enquête a été conçue dans le but d'étudier les individus de la diaspora de chercheurs colombiens à l'étranger par rapport au processus de « brain gain » qui, depuis 1994, a lieu en Colombie. Les réponses provenant de plus de 25 pays constituent un échantillon représentatif de la population concernée.

Sont discutés les différents aspects méthodologiques dont on doit tenir compte dans la réalisation d'une enquête, à savoir : définition de la thématique, définition des variables préalables à l'étude, types de données à récolter, élaboration du formulaire, localisation des individus, moyens d'envoi et réception des formulaires, organisation de l'information, préparation des données pour les analyses statistiques descriptives et spécialisées, validité de l'échantillon, types d'analyses descriptives et spécialisées.

Est illustrée l'utilisation de techniques modernes provenant de l'analyse de données telle que l'analyse de correspondances, l'analyse harmonique simple, l'analyse de données textuelles, l'analyse de mots associés pour l'étude d'enquêtes de ce genre. Ces techniques incluent de l'information de type biographique, sociodémographique, factuelle et d'opinion, information recueillie par le biais de questions ouvertes et fermées.

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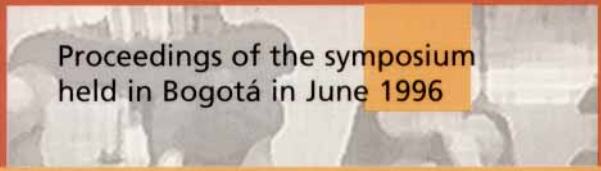
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The issue of the international mobility of skills has become crucial for world-wide sustainable development in a global knowledge society. This CD-ROM presents a large number of contributions dealing with this issue, under diverse perspectives and with different approaches. With recent evidence and new insights, it aims at providing the reader with abundant and useful materials to support any study of the international flows of competencies in Science and Technology.

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