Turning Brain Drain into Brain Gain: The Colombian Experience of the Diaspora Option

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An increasing number of developing countries are considering their highly qualified citizens living abroad as a potential asset for national development. Renewed policies are consequently designed in order to ensure the return of this expatriated talented group. Besides the repatriation-return-option generally enacted in these policies with varying success, a second one has recently emerged: the diaspora option. It consists of the remote mobilisation of intellectuals abroad and their connection to scientific, technological and cultural programmes at home.

At the beginning of the 1990s, Colombia began to systematically and consistently apply this option, through the creation of 'the Colombian Caldas' Network of Scientists and Engineers Abroad'. The experience of this strategy has been studied during the last four years by a Franco–Colombian research team. The paper discusses the results of this study. It first contextualises the diaspora option and the Colombian experience by putting it in historical perspective along with the other policies designed to tackle the issue of professionals' migration. It then describes the S&T diaspora in terms of actors and dynamics. The way it works through the Caldas network is presented in terms of an analysis of three major aspects: the electronic list through

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INTERNET, the local associations (network's nodes) and some joint projects between diaspora and the home community members. The concluding part draws the significance of the experience, its achievements as well as its limitations, and suggests indicators and methods that could help develop it elsewhere.

The Diaspora Option in Historical Perspectives

THE SPECIFICITY OF the diaspora option is obvious when compared to other policies. But it is not an isolated phenomenon without antecedents. Its emergence is the result of a gradual process.

Evolution of Policies with regard to Professionals' Migration

The policies adopted by developing countries with respect to the migration of their highly qualified citizens may be classified and summarised in two basic approaches, according to the interpretation given to this phenomenon. The first one, the brain drain approach, considers the negative effects of migration—a loss of skills for the country of origin—and reactions to these. The second one, the brain gain approach, focuses on the positive aspects—the existence of highly trained national human resources abroad—to use them as opportunities.[1] Both approaches have generated policy options. The countermeasures to the problem of brain drain have basically focused on three options: taxation (compensatory financial measures), regulation of flows through international norms, and conservation (control of emigration).

Taxation has received much attention and culminated during the second part of the 1970s and the first part of the 1980s (Bhagwati 1976). However, it has not been translated into actual decision-making and virtually disappeared at the end of the 1980s.

Regulation through international norms had early been proposed by organisations within the United Nations system (Pires 1992; UNCTAD 1983, 1984). These recommendations have not been enforced and the developed countries still apply selective immigration policies with regard to highly qualified manpower (Simon 1995).

Conservation (restrictive) policies aiming at the retention or recuperation of skilled people have been implemented in many

developing countries. But their scope as well as success has been limited, since they intended to stop or reverse the outflows without addressing the cause of the problem, that is, the absence of a S&T base that would absorb this manpower (see Mesa et al. 1978 on Colombia).

Brain gain strategies were increasingly developed as the limitations of the above-mentioned options became apparent. Their emergence may also be linked with the new status of science and technology in development planning for an increasing number of countries from the South. The first alternative to emerge has been the return option. Though this option appeared at the beginning of the 1970s (Kao 1971), it increased gradually through the decade (Glaser 1978) and was extensively developed in the 1980s and 1990s (Swinbanks and Tacey 1996; Song in this issue). The return option deviates from the conservation policies in a crucial aspect: the recovering of highly qualified professionals is part of a comprehensive development policy, including and often integrating scientific, technological and economic dimensions. It is not by random that the most successful cases of return policies have been seen in the NICs, in countries with S&T and industrial sectors already quite advanced, where the manpower may effectively be employed (for example, India, Singapore, South Korea and Taiwan).

The diaspora option is the most recent policy that has been fully implemented with regard to the migration of highly qualified human resources. As a brain gain strategy it differs from the return option in the sense that it does not aim at the physical repatriation of the nationals living and working abroad. Its purpose is the remote mobilisation of the diaspora's resources and their association to the country of origin's programmes. Scientists and engineers may stay wherever they are; what matters is that they work for their mother nation in some way. This is done through a formal, institutionally organised, networking.

Each of the brain gain options have theoretical advantages as well as limitations.[2] Both are not self-sufficient strategies: their success and effectiveness depend largely on the internal dynamics of the native scientific community. The scientists, either physically reintegrated or connected through networking, must find in it the relevant professional and specialised groups with which they can constructively and concretely interact (Gaillard, Krishna and Waast 1997).[3]

Antecedents of the diaspora option may be seen as early as in the 1870s during the Meiji era in Japan where expatriate students in Europe were organised to channel scientific and technical knowledge to their country. Later, from the same perspective, foreign students in the United States or in Europe have often come together, in terms of nationalities, within on campus associations. They often included some kind of commitment to the mother country. Interestingly enough, this has been the case in Colombia. In 1956, graduate students from the University of Leuven (Belgium) decided to form an association that soon became the 'Colombian Team for Studies and Progress' (ECEP). The ECEP aimed to move beyond the local level and set up an extensive and organised association. It survived for half a decade and included all the Western European countries as well as people in the United States. It operated through regular meetings of local groups, mail exchange and temporary visits, a general file of members and meetings of local groups coordinators (*Semana* 1959). Though technically different, these are the features that the Colombian 'Caldas' network also adopted some 35 years later.

Around the same time, India initiated the first national effort to locate and follow national intellectual resources abroad. It opened an 'Indians Abroad' section in the National Register of Scientific and Technical Personnel of India with the purpose of collecting information on qualified Indians in foreign countries. This register has mainly been used to feed the 'scientists' pool' of long-term appointments in India, which is considered more as a return option: It did not help to set up a network or another form of permanent intellectual diaspora as such. But, in the 1970s, 'the Council of Scientific and Industrial Research instituted a scheme for offering short-term appointments as research associates or visiting scientists' to Indians abroad (UNCTAD/CSIR 1977). This has been an intermediary mode between return and diaspora options: resorting to external skills for temporary employment at home.

The TOKTEN (Transfer of Knowledge through Expatriate Nationals) programme of the UNDP has worked the same way for two decades; it was launched at the end of the 1970s. It channels expertise required by a specific country, looking for an expatriate of the same country possessing the appropriate skills, through the UNDP network of regional offices all over the world (Courrier

1996; TOKTEN 1988). Undoubtedly, these programmes have developed the practice of using high qualified human resources abroad without having to think in terms of permanent and costly reinstallation. But they have not gone as far as to constitute a diaspora, an authentic community beyond the borders, as they relied on temporary and individual connections. The truly continual and collective commitments occurred only in the beginning of the 1990s when the diaspora option became an autonomous and complete strategy, organised as part of the national planning policies.[4]

There cannot be a model of what the diaspora option is or should be. The Caldas network experience, however, refers to its distinctive nature from the partial experiences that preceded the complete actualisation of the option in Colombia. It has three characteristics: worldwide permanent communication, autonomous peers' organisation, orientation towards joint projects and realisation. The first refers to the fact that the widespread diaspora and the national academic community in the country of origin share a common source of relevant information and have a space where they can develop direct and consistent exchanges. The second refers to the autonomy of the groups composing the diaspora: they do not depend on institutions of the country of origin or the host countries for existence; they have their independent statutes, juridical personality, auto-recruitment, selection and functional rules, etc. Third, this organisation, global and local, has a definite purpose of work sharing, or academic, technological and intellectual concrete cooperation. These combined features have been presented in the Caldas network through an electronic list, the local associations of Colombian scientists and engineers—the 'network nodes'—and joint projects or activities led collectively by the diaspora and home community members. This institutionalisation of an expatriates' network departs from anterior, more limited experiences of the diaspora option.

Colombia: Specifics and Generics of the Case

The so-called 'Caldas network' or 'Colombian Network of Scientists and Engineers Abroad' was officially established in November 1991, when Colciencias—the Bogotá based governmental agency incharge of national research management and funding—decided

to launch it as a programme to which one person of its staff was appointed. This was part of a dynamic process in which the institutional decision represented an important step but far from an isolated one.

The Caldas network is a hybrid construction, comprising diverse contributions. Apart from the decisive initiative from Colciencias, various interdependent actions, within and without Colombia, have had crucial significance. There was a clear political will, a central decision, from a public organisation in Colombia which combined with local, often individual, expectations and attempts that existed outside.

The network's members often claim that, even before its creation, they had personally tried to forge scientific and intellectual links between themselves and Colombia. They attribute the frequent failure of such attempts to the lack of reaction, decision and consistency from the country's institutions. Thus, for many people, these attempts to help had already been frustrated and deceived by the earlier plans which had fallen through. The Caldas network was established with this ambivalent feeling: on the one hand, a spontaneous motivation from the intellectuals abroad to contribute to the development of their country of origin and, on the other hand, the bitterness and pessimism generated by previous failures. These are the paradoxical tensions at work in the construction of the diaspora: a positive identification to the country—a constructive nationalism—but a negative appreciation of its responsiveness, a deleterious suspicion of national commitments.

What convinced some of the Colombian expatriates to participate in a new attempt in 1991? What is at the origin of the collective dynamics that emerged from various parts of the world at the same time? It is a combination of symbolic signals and concrete measures, coherently articulated in a highly publicised policy planning. At the beginning of the 1990s, the Colombian society was indeed in the so-called 'apertura' (opening up) period, ending an isolationist and protectionist era. Science and technology were for the first time accorded major importance especially because they were considered as the main vectors to upgrade the general competitiveness of the country. The idea that Colombia was undergoing an historical shift was well received by the intellectuals abroad. First, because the basic concept of 'apertura' semantically provided a retrospective

and definite recognition to those who had previously been exposed to the outside world: the expatriates. Second, because the emphasis on science and technology completed this general recognition with an operational value: they had a virtual, totally new role to play in their country's development.

These changes were not only occurring at a discursive level; they were embedded in concrete moves sustaining their credibility. In 1989–90, the academic community in Colombia undertook an extensive and far-reaching examination of the country's scientific directions. With the so-called 'Mission of Science and Technology' all the public research programmes came under review and their orientations toward the rest of society were reconsidered. This effort has placed the S&T sector at the heart of national development and it has achieved significant results. A law on science and technology was enacted leading to the creation of a National System of Science and Technology. A new institutional framework was designed. Colciencias, which formerly was mainly a fund for financing research projects, became a central agency whose mandate was to organise the activities within the National System of Science and Technology and to ensure that they were organised in accordance with general planning in other areas (Charum et al. 1996). Last but not least, public funding for R&D activities increased by 400 per cent in the following years. These aspects are fundamental to the understanding of the diaspora option: its emergence is not an isolated phenomenon; it is intrinsically tied to the international dynamics of the national community. A network of expatriate skills is an extension of it, not a substitute (Gaillard, Krishna and Waast 1997).

Since an early stage of this process, various Colombian experts living abroad have been involved, providing ideas and suggestions to their peers in the country. Sometimes these expatriates met informally in the resident countries to discuss the changes occurring in Colombia at the time. They were creating local groups of Colombian scientists and engineers, which constituted the nuclei of what soon became the 'nodes' of the 'Caldas network'. But these individuals and small groups completely overlooked the fact that others were engaged in similar pursuits in other parts of the world. May be after some time and without any particular long term collective purpose they would have simply vanished. But a

phenomenon aggregated these particular endeavours and integrated them into a cumulative mutually reinforcing process—the electronic connection.

At the beginning of 1990, an electronic list of Colombians abroad, 'Colext' began to list an increasing number of expatriates connected to bitnet, an exclusively academic electronic network. The history of Colext is an heroic one, a kind of a fairy tale in which a personal initiative taken by an isolated doctorate student located in CERN—a general call in the cyberspace to all compatriots abroad—was met by numerous immediately positive responses, to the surprise of the founding father. Colext is a list dedicated to social rather than professional—science and technology—exchanges in which every message sent to the server is automatically distributed to all the listed members, allowing a general and collective communication. Its first major debate dealt with the opportunity of returning to Colombia, at a time when the country seemed so well disposed to receive its expatriate, intellectual nationals. The electronic discussion was passionate and ultimately ended in a highly symbolic result: a large part of the listed members believed that they could better help the country from outside than from inside. Retrospectively, it appears like an opinion poll validating the diaspora option even before it formally existed.

The electronic list has had a tremendous impact. It constituted a real social space that generated a collective self-consciousness of a worldwide intellectual expatriate community. The communication through Colext allowed mutual identification of the actors and eventually suggested their association. This system led to the institutionalisation of the network from the diaspora. It is through its electronic reflection that its members became aware of its global dimensions.

The Colext effects have been translated into effective actions fairly rapidly. At the end of 1990, on Christmas, the listed members located in New York city decided to organise a meeting. They found 'PECX'—the association of Colombian students and professionals abroad—which some months later became the node of the Caldas network in the United States. At the beginning of 1991, the list was used by the general manager of Colciencias to hold the first round of meetings with expatriates in Paris, Madrid and Mexico. He actually visited these people in spring 1991 and returned to Bogotá with the conviction that a network was feasible. In

November, it was institutionalised under the auspices of Colciencias and it quickly developed through both the contagious examples of the first significant nodes (Paris and New York) and the massive political investment made by the staff of this governmental agency.

Obviously, the construction of the Caldas network has not been the result of a lineal and top-down administrative decision. On the contrary, it is the progressive implementation of an idea through a collective and iterative process, between a governmental agency and various expatriate actors. It has achieved consistency and credibility because it was tied to the structural institutionalisation process of the research community through the creation of the National S&T System. Other cases of the diaspora option may develop under different conditions. The broad political context may not be similar in other countries. However, the history of the Caldas network reveals a basic fact: if it has achieved initial mobilisation it is because it has been shaped through a collective process, which has assigned roles and interests to the numerous actors.

Actors and Dynamics of the Diaspora

When Colombia initiated the diaspora option, it had a vague idea of what its national intellectual community outside actually was. Consequently, the appraisal of what it could offer to the country was anything but precise. From this history of empirical construction, the Caldas network has always maintained an intuitive more than a rational management. In 1994 and 1995, the ORSTOM–UNC research team carried out a detailed and general survey in order to obtain a picture, as precise and as complete as possible, of the diaspora. More than 500 responses were received from a total of a little more than 1,000 identified and located people.[5] The answer rate was high, especially for a migrant population. Sophisticated statistical checking procedures confirmed the validity of the sample with the largest possible population—in our knowledge—of Colombian intellectuals, students, engineers and scientists abroad.[6] This permits an understanding of who the diaspora's members are and what are their involvements.

Who are the Members of the Diaspora? A Survey

According to the survey, the Colombian intellectual diaspora is spread today in, at least, 25 countries and in the recent past was spread in up to 43 countries. The United States constitutes the most important part of it as a single country but North America (the US and Canada) is second behind Western Europe in terms of regional importance (Spain, France, United Kingdom, Germany, Belgium, Italy and Switzerland). Latin America comes third; Eastern Europe, fourth; Asia-Oceania, fifth.

What is the age profile of the members? The average age is 37 years and a large majority of the population is between 24 and 44 years of age. The peak, however, is constituted by people between 30 to 40 years of age, who represent more than half of the total population. Most of them are either enrolled in doctoral programmes, or pursuing postdoctoral studies or even in a rising professional position in a definite career. The diaspora is neither a student population nor an executive. But it is a highly qualified community: 71 per cent of its members have obtained or are pursuing doctoral studies and 80 per cent have a Master's degree or higher qualification.

Almost three-fourths completed their undergraduate studies in Colombia but the proportion is completely reversed for graduate studies (27 per cent for the Master's, 7 per cent for doctoral programmes). Doctoral programmes are pursued outside the country, in the US (25 per cent), France and the UK (12 per cent), and Spain (11 per cent).

Of the 76 per cent who declared they had left Colombia to study abroad only 11 per cent migrated for professional reasons. Further, 8 per cent mentioned personal reasons and 5 per cent socio-political or other reasons. Three-fourths of them left for pursuing higher studies and most of them left after obtaining their Bachelor's degree for postgraduate studies. The argument that this is the result of the bottle-neck in higher education (the absence of advanced studies in many fields) is only partly relevant: it is true at the doctoral level but not the Master's level in most of the disciplines. The fact that the majority decided to leave the country before reaching the ultimate, locally available, stage in her (his) field seems more to be a choice than an obligation imposed by the conditions prevailing in Colombia or even other countries as other studies show (Gaillard 1991). People have largely acquired their

skills abroad. At the best, they had a general qualification when they left; today, after completing the major part of their studies and professional training abroad, they are highly skilled in very specialised areas.

Emigration is not a definitive evasion; it is a life sequence for professional and personal enrichment. When asked if they would return home and live in Colombia, three-fourths responded positively. Only 20 per cent believed that they would not live again in their country of origin. This result is confirmed by a survey of a small sample of people who have actually returned to Colombia since 1990: almost all of them declared that they would stay in the country and not return abroad. This clearly shows that the emigration is not a permanent one, it is temporary. This evidence coupled with the age distribution of the emigrants confirms that such a migration refers more to 'delayed return' than to the brain drain phenomenon (Pedersen 1993). People expect to return even if they spend a significant number of years abroad, as pointed out in other studies (Glaser 1978). However, the longer they stay abroad, the less likely they are to return (Gaillard 1991). This also has a bearing on the design of both—return and diaspora—brain gain strategies. First, if the majority of expatriates are expected to return, providing strong incentives to them may not be the major issue; on the contrary, providing adequate conditions for them reinsertion is indispensable in order to optimally benefit from the skills they have acquired abroad. Second, the diaspora is not a totally stable population and entity on which one can rely indefinitely; once the connections have been made its moving configuration has to be managed dynamically through on-line, non-static indicators and data.

At the time of the survey, the average number of years each person spent abroad was 5.5 years. There may be considerable variations between those who left some months ago and those who migrated more than 15 years ago. But the general figures give an idea of the kind of migration under consideration. There is a durable and effective settlement in the foreign countries, propitious to the development of strong links with their environment.

The Diaspora's Dispositions towards Colombia

What are the members of the Colombian intellectual diaspora able and ready to provide to their country of origin? This depends on

their socio-professional insertion abroad as well as on their individual and collective attitudes towards Colombia.

Half of the population surveyed had a student status, of which 74 per cent had enrolled in a PhD programme, 18 per cent Master's degree programme and 8 per cent in undergraduate studies. Two-thirds were under professional contracts; one-fourth were both studying and working; 83 per cent declared that they were involved in research activities, either as advanced students or as professionals. The intellectual diaspora is a real potential of knowledge and practice and it covers many fields. But this broad and complete coverage is also an expression of the extreme dispersion: there were as many as 290 thematic specialities for the sample of the survey, revealing that very few people shared the same field of research. This poses both an opportunity and a problem for the diaspora and for Colombia. On the one hand, it is a tank of expertise which is very extensive and can respond to many cases; on the other hand, the construction of teams, of collective—even virtual—work is hampered by cognitive distances between potential partners.

The socio-professional involvement of the intellectual diaspora's members is clearly academic. The majority of them work in a large public institution whose primary purpose is higher education, that is, a university. These features are similar to those of the scientific community in Colombia where the bulk of research is carried out within the large universities of the public sector (Meyer et al. 1995). In terms of general orientation, the diaspora does not complement the internal community. It especially lacks involvement in the R&D of the private productive sector. But in terms of capacity mobilisation, it is potentially quite strong as most of its members belong to large institutions involved in knowledge generation and diffusion.

The professionals enjoyed their job and positively evaluated the labour conditions in the foreign country. The aspects they valued most in their position abroad in descending order were access to international contacts and mobility, access to technical capacities, support of qualified personnel, intellectually stimulating professional relations, career prospects and job prospects in Colombia. The only aspect regarding which the majority (51 per cent) responded negatively was the income they earned. Regarding their professional relations, an overwhelming majority perceived them to be friendly,

productive, intellectually stimulating, non-hierarchical and non-precarious.

The positive evaluation of their environment by the diaspora's members reveals the potential resources that they may provide to their peers in Colombia: good and extensive social networks as well as technical and professional facilities.[7] Are these potential resources actually exchanged between the diaspora and the internal community? Is the Caldas network really effective, in its attempt to connect the two?

The membership of the Caldas network provides an answer to these questions: 90 per cent of the respondents mentioned that they were aware of the Caldas network, but only 68 per cent had sought membership. This means that 22 per cent did not want to get involved in this institutional effort to associate the diaspora with the national community, even if they knew about its existence. This is an important fact: some people may not be willing, for a number of reasons (lack of time, indifference or critical stance toward the country), to be formally part of a collective and regular commitment to their nation of origin. Moreover, a significant part of the members had recently joined the network. Therefore, the sample is not adequate for an evaluation of the durability, consistency and intensity of the members' involvement. But an appraisal of their propensity and their capacity to develop actual links with Colombia may be made.[8] In order to do so in an exhaustive and systematic manner, a multivariable correspondence analysis was applied to the responses given by the expatriates to a large number of questions about their expectations regarding the network, the benefits and contributions that they would draw or make through it. The analysis clearly identified and distinguished three groups—statistical clusters—with typical attitudes toward the network. The three groups were approximately the same size: 144, 149 and 160 individuals, respectively, that is, 32 per cent, 33 per cent and 35 per cent of the sample.

The first group comprised those who did not expect any particular benefit from the network. They did not evince a keen interest in establishing professional or academic links with Colombia by participating in training sessions, project assessments and evaluation, or receiving researchers or providing them with facilities. They were far removed from the needs of the country and did not wish to visit it. They did not have any relationships with the

expatriate community either. They did not think that the network would enable them to acquire recognition or strength either in the resident country or in Colombia and that they could tap new and interesting work opportunities through it.

The second group was characterised by an attitude of hesitation: its members did not clearly express expectations regarding the benefits they could possibly derive or the contributions they could make. But they were not indifferent either; they wished to visit Colombia and share activities with the researchers there. They believed that the network had opened new opportunities for them in terms of projects realisation, access to funding and possibilities to influence science policy decisions.

The third group was far more affirmative. It expressed an interest in forming an association with the national local community and a desire to strengthen the expatriate community, to establish exchanges with their peers of the internal community by participating in training sessions, project assessments and evaluation, or receiving researchers or providing them with facilities. Participation in the network, they believed, could enable them to get recognition for their work and they wanted to contribute to the country's development. Their experience and knowledge, they believed, would have a positive influence on the design of science policy.

The diaspora is anything but a homogeneous community. Its members' attitudes vary from indifference to commitment with hesitation in between. There are thus three concentric circles: a core group, actively involved; a medium group of favourable but uncertain people; and a periphery of distant members. The survey reveals an instantaneous picture of the diaspora at one point in its history. The distribution of the groups may change and individuals may pass from one to another according to the dynamics of the network. Its management thus requires appropriate incentives to make it attractive and to stimulate activities.

Global and Local Dimensions of the Network

A population of expatriate individuals does not automatically constitute a diaspora. It becomes one when it is a community whose members are in communication, have built and institutionalised a

collective autonomy, and share some goals and activities. This is what the Caldas network provides through its electronic list, local nodes and joint projects.

Electronic Worldwide Communication

According to the survey, the majority (58.5 per cent) of the diaspora's members have access to the Internet and use it as a communication medium; this proportion, however, may vary from one country to another.[9] In 1993, an electronic list—'R-Caldas'—was created, exclusively dedicated to academic exchanges and independent of the original Colext list, more oriented towards social and trivial matters. R-Caldas is the only common space, the unique permanent meeting point, shared by the diaspora's members wherever they are and therefore it constitutes the mould of its identity. The list and its activity have been systematically observed over a period of three years, from its inception in the early part of 1993 up to the beginning of 1996 (Meyer and Granés 1996).

The development of participation in R-Caldas revealed an exponential growth during most of the period, slowing down towards the end of the period because its field of expansion came to exhaustion. The participation in the list was not characterised by volatility. The electronic population of the diaspora was quite stable: though many people joined and some left after a while, the rate of stability (permanence between several electronic censuses) was high. It showed as increasing trend over the period, thereby indicating that people were generally faithful to the list, at least during the period under study.

The subscribers are geographically and institutionally dispersed, except in Colombia where the concentration is in some universities. The proportional importance of this country has dramatically increased over the years, from 11 per cent in 1993 to 26 per cent in 1996, partly due to the local extension of the Internet through its national representation RUNCOL and the CETCOL. An increasing number of people in Colombia are connected to R-Caldas and are able to communicate with the expatriates. The increasing concentration in Colombia in contrast to the initial dispersion worldwide changes the shape and perhaps the nature of the diaspora: from an original nebula it is being transformed into a centred system.

The number of message emissions has grown in the same proportion as the number of participants. There has been a twofold increase every year, from 160 in 1993 to 311 in 1994 and further to 620 in 1995. The list R-Caldas appears to be quite dynamic: participation and communication have increased significantly during the period. However, the emitting activity is concentrated: 63 per cent of the participants on the list never sent a message. These people are 'lurkers'—invisible users—a silent majority which appears to be a general characteristic of the electronic lists (Simon 1996). They are obviously not indifferent since they remain on the list and keep receiving without posting. On the other hand, the 5 per cent frequent senders during the period under study, represented 63 per cent of all the electronic communication posted. After a while, these people and their ideas or inputs are identified and recognised by others. The list is not an anonymous place. It has built its internal references determining the scope of communication for others as well as newcomers.

The bulk of messages is emitted from Colombia, that is, almost half of the total. This has much to do with the fact that the coordination of the Colciencias network in Bogotá uses the list as its major instrument for the dissemination of information to the diaspora. It represents half of the contribution from Colombia. Apart from Colciencias, many other Colombian institutions and individuals send messages, far more than in any other country including the United States though it has twice the number of Colombia's subscribers. There are more lurkers in the diaspora than in the national connected community. Colombia is an emitting centre; it is not only a centre of attraction of the diaspora's information.

What do the people exchange in this list? Definitely, substantial messages. A large majority of them are between 1 and 5 pages, thereby indicating that the messages are prepared, they are elaborated and dense. This is different from other academic electronic lists, where the frequency of messages is higher than in R-Caldas, but the density is lower. Unlike the other lists, R-Caldas is not concerned about scientific debates; in fact, it is not a discussion list: its use is more instrumental than social. It is also far more utilised to provide (information, announcements, opinions, call for tenders, warnings, offers, suggestions and congratulations) than to look for something (requests, inquiries). The list is a

diffusion place from which the silent majority get fed with information from the network and may use it to determine their professional strategies in relation to Colombia.

Messages are sent to every subscriber to the list, as the distribution is automatic through the server. But they generally have particular implicit receptors: only 36 per cent of the messages are directed to all the list members, while 4 per cent to individual receptors (open letter with copy to the list), 7 per cent to institutional ones, 7 per cent to receptors of a specific geographic zone and the majority (46 per cent) to particular thematic (specialised) groups. The importance of specialised information distributed through the list highlights its professional character. R-Caldas is like a flow of information in which one selects and uses what is of personal relevance. No less than 71 specialised groups have been identified through the message contents showing the cognitive dispersion of the population and confirming the conclusions of the survey.

The large areas of knowledge covered by electronic communication may be compared to their respective production in Colombia, as defined by the PASCAL publications database (Meyer et al. 1995). The following phenomenon is evident: the hierarchy is diametrically opposed. High technology, hard sciences, natural, earth–environment and health sciences is the decreasing order in the R-Caldas electronic communication while it is the increasing one in the Colombian scientific production. Therefore, the stronger a field in one part, the weaker it is in the other. The activity through the network is complementary to the one developed internally in Colombia. It may especially help to upgrade the technological innovation capacity which has become extremely important for industrial competitiveness in the newly opened economy.

The electronic activity through the list also has an impact on the institutional setting of the scientific community within Colombia. Its actors emitting messages in the frontier fields of high technology are those who are not very much visible in the traditional production of knowledge as revealed by the PASCAL database. As if the electronic network was used to open new spaces, to address new professional groups and thus change the patterns of recognition and the disciplinary trends within the national community. The diaspora is not an appendix of the latter; it develops new activities and orientations that some actors—expatriate or not—may take as opportunities to develop original strategies.

Local Nodes and Activities

The diaspora is organised in local groups, the network's nodes. They are associations of scientists, engineers, students and professionals officially working for the development of Colombia under an NGO status in the resident country. They have an executive committee and a president representing the node of the Caldas network and acting as its local coordinator and direct contact for Colciencias. There are 21 nodes which have successively emerged between 1991 and 1995 in the following order: the United States, France, Spain, Canada, Switzerland, Sweden, Belgium, Italy, Australia, New Zealand, Puerto Rico, Venezuela, Argentina, Mexico, Austria, Poland, Japan, Germany, the United Kingdom, Russia, Brazil and Hungary. There are also small local groups or isolated individuals in other places, without formal recognition. The overall population is approximately 1,000 but the participation and involvement are very diverse and the level of activity and integration of the nodes may vary considerably from one country to another.

Every node organises its associative life as it wants. The membership has been the first issue: should the association include scientists and engineers from every field or be restricted to some fields or at the opposite, extended to intellectuals and professionals without any limit? Should it include students or be restricted to senior? In general, sometimes after strong debates, the nodes have chosen a non-selective, wide open, policy. Today, most of them are actually associations of Colombian intellectuals even if the professionals and doctorate students specifically involved in the research sector represent the majority.

The general orientations of the nodes may vary according to influences emanating from the particular features of the resident country or from the very history of the local association. The nodes may thus be classified along an axis with two poles: the 'exo-centred' nodes (outward-oriented) at one end and the 'auto-centred' (inward-oriented) at the other (Schlemmer et al. 1996). Belgium could be placed at the former end. Its activities and members are oriented toward international practice. For example, they have organised a meeting of all the European nodes in Brussels to discuss Colombian science policy and cooperation with the Commission of the European Union. They believe that many

activities of the network should be set up at the European—instead of the national—level, for economies of scale and the achievement of a critical mass that they do not have in a small country like Belgium. For them, the local node is just a part of the whole. This is in contrast to what happens in the UK association which does not maintain many contacts with the other nodes and develops its own, independent activities, like the scientific meeting of Colombian biologists in the country.

Other nodes have more balanced orientations and/or a different configuration. The German node, for instance, has adopted the federative organisation that is also seen in the country: it is decentralised, with local groups in the various 'lander' universities. The New York group has tried to spread and to find subsidiaries in other US cities with little success. The French and Spanish nodes were sometimes bicephalous with concentrations in Paris and Madrid as well as in Grenoble and Barcelona, respectively. The members in Australia and New Zealand are scattered while those in Venezuela are largely concentrated in the same institution in Caracas.

The evolution of the nodes has been as diverse as their origin and configuration. However, a general pattern may be described. Initially, there was enthusiasm. The inception of the network has generated an inflation of expectations from the diaspora's members who have joined the proliferating nodes in significant numbers. Colciencias' propaganda for the network has met with high receptivity and participation. The initial mobilisation has operated even beyond what the first actors would have thought, in many cases. In the second phase, part of the population of the older nodes has gone through a period of doubts and disillusions because the network did not respond to their particular concerns. Some nodes have never really taken off, to expand beyond the nucleus of the original founders. In fact, many people critically view Colciencias' role in this process. According to them, the agency has not been able to respond to the expectations that it had raised when it had invited them to participate. These people often demand greater support from Colciencias to the node's life and activity, through direct funding of infrastructures (permanent secretariat) of the association. Others, however, are highly sceptical about Colciencias' involvement, fearing what they perceive as an inefficient bureaucracy. Therefore, the situation is somewhat ambiguous

considering the contradictory opinions and behaviours being expressed.

Efforts have been made to overcome the difficulties. A symposium of the network was held in Bogotá in July 1994, at which the nodes' coordinators were invited for discussion, under the auspices of Colciencias. The symposium provided a forum for addressing the various issues at stake and for maintaining the dynamics. Nonetheless, crucial problems like the nodes' capacities and resources have not found definite solutions. Another meeting has been planned in the near future in order to define a precise policy regarding the network's objectives and necessities.

Till date, the nodes have developed activities taking advantage of casual opportunities and without a general plan for the diaspora. The results are plentiful and dispersed. Several scientific meetings have been organised at the local level with fertile exchanges. Diffusion of information through the network's coordinators has allowed the expatriates to be increasingly in touch with the opportunities in Colombia. International cooperation in favour of Colombia has been enhanced through the network's members acting as 'scientific ambassadors'; expertise has been mobilised for the advancement of particular studies. But the ultimate and major purpose of the Caldas network is the concrete realisation of joint projects between the diaspora's and Colombia's research teams. This is what truly justifies the very existence of the network: an active contribution eventually internalised in Colombia. This has occurred in a small number of cases.

Joint Projects

Joint projects were first launched in 1994 and some of them have already been completed. They particularly demonstrate the multiplier effect of the diaspora option. They also highlight some of the difficulties, limitations and shortcomings to initiate and implement on a sustainable basis collaborative research projects between Colombian scientists at home and abroad (Granés, Morales and Meyer 1996). Three such projects will be discussed in the following which had different results and implications.

The first is the so-called Bio-2000 project which highlights the ambitions and deceptions that may accompany the evolution of multilateral cooperation through the Caldas network. This project

was launched in 1993 when European and North American based Colombian researchers wanted to explore the possibility for Colombia to launch a R&D project in biomedical applications of physics. With the support of the Universidad del Valle (Cali), a specific electronic list, originating from R-Caldas, was put in place with the purpose of defining the programme. It initially mobilised several nodes (Switzerland, New York and Houston). At the first meeting, held in Cali in July 1994, the most interested and competent people in the area participated. The project network was initiated with the goal of a concrete, multidisciplinary study (physics of particle detection, electronics, informatics, biology, nuclear and molecular biomedicine) to develop high level/low cost research capacities in a field manageable for countries such as Colombia. Fairly early, the project encountered two contradictory forces:

1. On the one hand, the slow pace of development in Colombia where the institutions supposed to provide the administrative basis for the project had difficulties in meeting the expectations of the diaspora.
2. On the other hand, a 'push forward' from the expatriates who were expanding the project with the hope of pressing the Colombian authorities by the inclusion of eminent scientists or with some commitments from funding organisations (UEC, Philips).

After two years, an equilibrium was found. Partners from the North would cooperate but not by creating new areas of research: teams from the South would have to adapt and select the fields they could manage. The 12 associates abandoned the idea of a unique federating objective and chose to develop several joint studies, each of which had various laboratories and teams. A year later, the project was still in progress but in a limited form: 5 universities participated along with the CERN and outside Colombia (in Spain, Italy, Brazil and Peru) with individual researchers from Bogotá and Cali and without the expected regular involvement of Colombian institutions. Though those who stayed realised a coherent project, some discouragement could be seen. Compared to the initial ambitions, the scope of the project was substantially reduced to bilateral, at the best trilateral, cooperation instead of the broad-based mobilisation envisioned at the beginning.

Moreover, the role of Colombia became paradoxically, comparatively minor in the project.

This example has been chosen to illustrate the extent to which the setting up of a project may be confronted by different logics: scientific and national, North and South, logics proper to a given institution or an individual researcher. Furthermore, while a project may be successful, its promoter may not necessarily be rewarded for it. As a way of illustration another example is discussed in the following.[10]

Jorge, a chemist from the National University in Bogotá, went to Sweden to complete his MSc and PhD. He married a Swedish woman and decided to stay in Swedan where he is engaged in contract-based research work in a public medical laboratory. Though he does not participate in the activities of the Swedish node of the Caldas network he knows most of its members. Along with a former friend, a microbiologist based in Bogotá, Jorge designed a collaborative project which he launched in Bogotá during a 6 month stay thanks to the support of Colciencias. According to both of them, the Caldas network has not been instrumental in establishing the connection since they knew each other earlier. But Jorge's visit was funded through the network's short time exchange programme. The collaborative work in Bogotá was productive and successful. It led to the development of a 'user friendly' technique for separating proteins. The results were presented at several international conferences and were published in a joint paper in a reputed journal.

For Jorge, the difficulties began when he returned home to Sweden. His laboratory in Sweden was pursuing a completely different line of research and he had a hard time trying to catch up and to submit research proposals in order to obtain research grants on which his salary depended. What he had accomplished in Colombia was hardly rewarding for him in Sweden even if he acquired increasing international visibility. On the contrary, it nearly jeopardised his precarious research career. Since he returned to Sweden he had virtually no connection with his friend in Colombia. Clearly, research agendas and constraints in Colombia and in the North do not necessarily match in the long term.

The third project focuses on transfer of technology in robotics and automation between a university centre in Paris and another one in Cali. The objective was to build in Colombia a robot for

industrial purposes. As expertise in this field in Colombia was limited, the idea was to utilise French experience, through a member of the network, and develop it with his knowledge. What was to be transferred were some pieces of the robot—to be assembled in Colombia—and the sophisticated know-how to make it work. The expatriate Colombian engineer in France was successful in involving in the project the manager of his institution, several French colleagues, knowledge and equipments, funding from the French government, which in a cumulative process, convinced Colciencias in Bogotá to co-finance the project; the project involved doctoral students from the Universidad del Valle (where there was no doctoral programme) under dual guidance from one professor in Colombia and another one in France. The robot is functioning in a mechanical engineering firm in Cali and may even be alternatively activated from Paris through the Internet. The multiplier effect worked efficiently and generated unexpected developments in Colombia. The country now has a dynamic group in automation and robotics which is able to take its own initiatives for further cooperation. It has started to develop programmes with German teams, for instance.

These projects are isolated examples of spontaneous initiatives made by individual actors. Without their firm commitment and consistent determination, the projects would not have taken off and expanded. The Caldas network directly or indirectly helped them to build the proper connections. But it could do much more: it could generate and multiply the associations through available relational methods and indicators.

Lessons and Instruments Derived from the Colombian Experience

Today, many countries and organisations are putting into practice the diaspora option under various modalities (Portnoff 1996): the UNESCO with a database of Latin American expatriate scientists and engineers (Cardoza and Villegas 1996), Chile and Croatia through e-mail lists (Rojas and Palacios 1996; Cano and Pifat 1996), Venezuela with a scheme comparable to the Colombian one (De la Vega 1996), Arab countries with a US based association, Tunisia through local associations (Belgacem 1996), China in biological sciences (Stone 1993), Hungary (Halary 1994), Argentina

(Rudin 1990) and Uruguay (Pellegrino 1996). Such countries as Ethiopia, Eritrea, India, Israel, Singapore, Taiwan, South Africa, Morocco and Rumania are actively considering it in one way or another (Gaillard and Meyer 1996). There are many ways to implement the diaspora option. However, two basic, related questions remain: does it actually transform the negative effects of migration into positive ones? What are the possibilities to ensure its optimal utilisation? The Colombian experience offers a clear positive answer to the first question and provides concrete perspectives on the second one.

The study of the Caldas network presented here has been limited to the discussion of the preliminary results of this experience. Its complete evaluation and the full impact of the diaspora option on scientific development will have to wait a few years and comparative studies are needed to assess their importance. However, the results may be summarised under five types of contributions made by the expatriates, which would not have been possible without the network:

1. Policy design and implementation.
   The National System of Science and Technology has called on specialists abroad to participate in their eleven disciplinary councils for designing the policies in each of these eleven fields. The network has permitted experts to appraise or evaluate projects funded by Colciencias. It is thus a pool of expertise for independent peer review to assess the scientific quality for the agency that has to select projects.
2. Scientific and technological training.
   Specialists from abroad have been invited for short visits to Colombia (1 to 8 weeks) for training sessions in their area of specialisation. Graduate students have been linked with institutions abroad through the network members.
3. Animation and communication.
   Local nodes of the network have organised scientific meetings on various subjects and have invited Colombian scholars to participate in these meetings. They often invite members of the network, not only members of their node but also of other nodes. The electronic list R-Caldas, to which many members of the network are connected, is a major source of

shared information on meetings in any area, professional positions, grants or training available in Colombia or in any part of the world, or on contacts, bibliography, references or resources to carry out a specific project.

4. Programmes and projects.
   Some research projects have begun to link people outside with the people in Colombia in such areas as physics, biotechnology, automation, psychiatry and biochemistry. These projects are often of one to several years in duration or may even aim to establish a permanent structure such as the creation of an academic centre with a doctoral programme in a provincial university. From the list of the local nodes' members, Colciencias has been able to build a central database of the expatriate human resources worldwide. This is a powerful tool to generate new projects in strategic fields for the country's development.
5. The Caldas network facilitates the return and reintegration of expatriate scientists and engineers under good conditions.

The above-mentioned results of the Caldas network reveal that the diaspora option is a real and workable proposition to transform the negative effects of emigration into actual benefits. It concretely addresses the problems that the brain drain countermeasures were unable to solve:

1. Instead of hardly feasible taxation policies it uses migrants'—substantial though non-financial—remittances: intellectual, technical, relational.
2. It does not depend on long-term regulations since it is a pragmatic, independent, national policy with some immediate dividends.
3. Instead of a conservative, restrictive policy toward the local community, it expands its capacity through the network evolved from the diaspora.

With regard to the other brain gain policy—the return option—the use of the diaspora is a complementary, not a contradictory, strategy. In Colombia, the Caldas network has been successfully

used in combination with the 'repatriation programme' of Colciencias and other institutions. People have been contacted and have negotiated the conditions of their return through it. It is well known that adequate reintegration is more likely when the expatriates have maintained and developed working relationships with their national professional community (Glaser 1978). As the location of the diaspora and the migrant status are not permanent features, the network is an excellent way to manage highly qualified domestic labour market issues with better knowledge, as much for the expatriates as for their local potential employers. The evidence that the return and diaspora options may be conceived in complementary, even synergetic, dynamics is that the NICs (Far Eastern countries) with strong repatriation programmes are today involved in decisive networking actions with regard to their professional expatriates.

The crucial advantage of the diaspora option resides in its flexible networking component. It does not require massive infrastructural investment beyond the reach of many developing countries. But it does require a firm commitment with regard to policy and strategic thinking in relation to management. The first ensures the initial mobilisation of the diaspora and the second its optimal use and sustainability. The Colombian experience has been positive in relation to the first and short on the second. This illustrates the obstacles that some developing countries would have to overcome when applying the diaspora option strategies. The acquisition of technical and administrative capacities that they require would probably only be achieved through international cooperation.

In Colombia, the strong political signals sent to the expatriates at the beginning of the decade have led to the creation of a real intellectual diaspora. But it has fallen short of defining a strategy about their use, their contribution to and their retribution from the country. Consequently, the diaspora is left to individual—often isolated—spontaneous actions instead of capitalising on the vast available field of expertise. It relies on occasional initiatives from the more active participants—the first circle of the diaspora—without any capacity to extend or generalise them within this circle or to reach and mobilise the second and third ones. To develop such a capacity, more than policy decision is required; it is a question of strategic management and technical instrumentation.

The major difficulty of the diaspora option is linked to the very nature of the expatriate population: it is heterogeneous and dispersed. This has various interrelated consequences. First, the precise identification, location and qualification of the diaspora's resources are difficult. Second, the determination of their possible contribution, their association within national programmes and their actual linkages with local teams have to be thoroughly investigated. Third, their dispositions or availabilities and, therefore, the modalities to foster their active involvement, are unknown. These three types of difficulties point to the dispersion of information that characterises the diaspora option and that fundamentally affects decision-making about it. Answers to these issues have been explored through the Colombian case study. It is seen that precise and reliable maps may be designed, permitting the country to locate actors, cultivate dynamics, generate policy orientations and channel resources accordingly, in the almost unlimited field of the extended national community and its networks.

These mapping techniques are now well known and in permanent development (Callon et al. 1986; Polanco et al. 1995; Vinck 1991). They have been applied to the research database of the Caldas network and a study to integrate them into a comprehensive package with multidimensional—not only cognitive—information, is being designed (Charum 1996; Montenegro et al. 1996). Obviously, these navigation tools need adequate formalisation and presentation in order to be accessible by researchers, institutions and managers on a daily basis.

The systematisaton of the diaspora option through these techniques would lead to an optimisation of its potential. The cross-fertilisation of the national, internal community and the diaspora are no longer left to random and unlikely encounters. They may be planned, managed and worked out by the actors themselves, once the scope of the virtual partnerships has become apparent through the maps.

The Colombian experiment has not gone as far as to develop an optimal use of the diaspora it has achieved to create. It has remained at the stage of empirical, 'blind' management. But the case study has pointed out the necessity of systematic methods and has generated the design of appropriate indicators. The next stage in the development of the diaspora option could be its rational though flexible implementation through such kinds of instruments.

NOTES

1. On the theoretical aspects of this question, see Meyer and Charum (1995).
2. While the return option may fully use the professional repatriate, the network diaspora must partially rely on the expatriate who can only marginally dedicate its activity to it. But while the return option mostly takes advantage of the 'embodied knowledge' of the person reintegrated into the national community, the diaspora option benefits from all the heterogeneous resources to which the network's actor is locally connected (equipments, colleagues, data, documentation, institutions, funds). Return and diaspora options have different impacts on the development process of national scientific communities: the first has a definite additional effect while the second has an aleatory multiplier effect.
3. Brain drain and brain gain options may sometimes overlap. For instance, the principle of resorting to the diaspora's skills and resources had been intuited within the Reverse Transfer of Technology, a typically brain drain approach. But, it was not explored to the extent of traditional options (UNCTAD 1983).
4. Other examples may be mentioned of countries having resorted to the use of their intellectuals abroad (France, Greece, Israël, Peru, the Philippines, Turkey, for instance). None of them have gone further than the ones presented here and they all have fallen short of the Colombian case.
5. According to governmental sources, the S&T Colombian diaspora would be around 2,000 people. This represents more or less 0.5/1000 of the overall Colombian migrant population in the world and a little less than half of the people officially involved in R&D activities in Colombia.
6. Identification and location of these people was done through numerous census and membership lists emanating from Colombian institutions (Colciencias, Icfes, Icetex, embassies), from the network's nodes coordinators and individuals, from the British Council and from electronic lists. Nevertheless, there cannot be any evaluation of the absolute representativity of the sample since the exhaustive population—if it could supposedly be defined—is unknown.
7. The propensity of the expatriates' partners in the host countries to work with Colombia is an interesting aspect. It seems that cooperation offers prestige, recognition, access to funding through cooperation agencies or programmes, etc. But this may be different according to the actors: private firms may be reluctant to relinquish information. Also, some countries have expressed concern (the USA, for instance) about 'knowledge drain' in strategic sectors and tend to limit the access of foreign students to these. The development of the diaspora option may be altered by this current phenomenon of privatisation and restrictions to information in S&T activities.
8. When asked to describe the difficulties to be overcome in Colombia in order to improve relationships with the country, the majority of the people mentioned more technical problems than social ones. In terms of possible advantages existing in Colombia for joint projects with the diaspora, the survey emphasised two points: on the one hand, the existence of personal contacts (mainly in the academic sector) for identifying and locating potential partners, and on the other hand, the absence of institutional support for projects realisation. This obviously provides a space for the Caldas network as an instrument aiming to fill this institutional vacuum by offering facilities for shared activities.

9. In the New York Caldas node, it was observed that at the time of the survey only one-third of the members has access to the Internet.
10. Names have been changed to ensure anonymity.

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