Journal of Scientific & Industrial Research Vol. 50, February 1991, pp 133-144

From a Sociology of Interest to a Sociology of Innovation: Transfer of French Technology to Brazil*

INTRODUCTION

Technical innovation can result from several processes, though most frequently it occurs in the context of transfer of technology. By studying the process of transfer over long-term, one can examine the conditions that are conducive or non-conducive to the process of innovation.

It has always been considered that economic factors determine the social and sociological aspects of transfer of technology. However, one can now see that the latter are being increasingly taken into account as much by the technology-offering countries struggling for economic success in a highly competitive world market, as by those seeking technology. For, each country, company, or social group within the company, is far more conscious about the development methods that they are yet to discover and they cannot restrict themselves to a simple imitation or repetition, i.e. reducing everything to technique. They must take into account their own social contexts, so as to obtain the best productivity/quality through the social form in which their actors are mobilised, who are, after all, not only technical and professional beings, but also social.

The present article aims at studying the relation between the conditions which contribute to the process of transfer and bring the two companies together and the dynamics of work collectives and the transfer agents. The latter are spurred by a rationality that is not purely techno-economic,

*The actors and the companies are real, but their names have been changed.

**Director, Research,

Institut Francais de Recherche Scientifique pour le Development en Cooperation (ORSTOM), 213, rue La Fayette, 75480, Paris.



R CABANES**

otherwise, it would have sufficed to study companies as units of action. It is basically also ethical, thus bringing into play such aspects as nationalism, development ideologies, or even specific social group interests.

sider Alter

The hypothesis, therefore, is that the framework within which the transfers take place, and are concretised, never fully defines the modalities of cooperation or of conflict between the work collectives. The modalities of this cooperation, whether finally elaborated or not, allow us to observe the real capacities of technology-giving company that have to be transferred (how to run equipment or a process under new conditions, or the receiving company's readiness to learn), and the receiving party's capacity to make use of the foreign technical know-how which must be understood by them before being adopted. This "exchange" of knowledge is inevitable: it may not take place for reasons linked to the conditions of transfer; but it covers the modalities of the existing cooperation as also the possibilities for future collaboration. Thus, norms of cooperation are established between the work collectives which are internal to themselves, and go beyond the issues that bring about this cooperation. Therefore, this context of cooperation must be given its due place, hitherto ignored, which it re-acquires in the process of transfer, so as to examine the extent to which it restructures the basic issues. It is thus necessary to cross from a sociology of interest, the most frequently used paradigm for transfer studies, to a sociology of innovation in the context of transfer.

An analysis of the relations of cooperation over long-term is significant to the chronology of events that we have located

Fonds Documentaire ORSTOM Cote: B # 13477Ex: 1 133

again in their context. Therefore, an attempt is being made to describe, for each of the cases studied here, the context of the country, of the companies, and their relations. Attempt is also being made to comprehend the reasons behind this cooperation or non-cooperation at its different stages, from the conception of a product to its manufacturing, from the conception of a process to its realization.

CONTEXT

THE CASE OF PUM (1) IN BRAZIL

PUM was founded in Brazil in 1954 by F Sider, the owner of the French CASP. It is a factory in the countryside in a small city (160 km from Sao Paulo) as in France. Right from the beginning, a paternalistic form of management is instituted (restaurant, sports, "celebration" of secular or family festivals in the factory) with the help of about one hundred skilled French workers. Several of them have actually settled in Brazil. Right from the start, parts of hydroelectric turbines were manufactured—a product which concerns us for this casestudy—some of them had already been sold a little before this installation.

In 1968, CASP took over IBHY, the main designer and manufacturer of hydroelectric turbines in France. SVP, specialised medium-scale hydraulic Study Bureau, whose main share-holder was CASP, was also in the same company, and IBHY worked mainly with EDF ("Electricite de France", This is taken as the starting point since it corresponds to the launching of massive hydroelectric barrage programmes, undertaken by the military regime of Brazil. When the CASP was liquidated in 1985, IBHY entered the TOMALO group which manufactured gas turbines (under license from the General Electric, USA), and which had taken over the TARO (steam turbines) and ROGE (pumps) companies. This coincided with the end of the big barrages in Brazil on grounds that State was heavily indebted, and which allowed PUM to plan again its productive activity easily.

Today, TOMALO (70%, of which IBHY-19%) is the main shareholder of PUM: the other share-holder is MAN, a German maritine diesel motor manufacturer. For reasons given above (absence of state finance), this activity for guite some time now has been facing a severe recession in Brazil.

Among the competitors of PUM is a German multinational in which the majority capital is Brazilian, and a Brazilian company which works under foreign or French licenses (TOMALO for the thermal power stations).

THE BRAZILIAN STATE AND TRANSFER OF TECHNOLOGY

The role of the State as the arbiter of national interest outgrows in this case, since it is also a client; it plans the energy resources development, and procures and administers international loans.

STATE AS A LEGISLATOR

The legislation of the National Institute of Industrial Property (INPI) stipulates (article 15) that a parent company cannot sell technology to a subsidiary. The objective is to stimulate the creation of joint ventures in which the Brazilian companies have majority shares; in that case, the transfers of technology can be paid for. Obstacle to selling, among other factors (for instance, a majority share-holding foreign company can not obtain long-term finance from the National Investment Bank), can be such a constraint that certain companies modify their capital in a way that they manage to hold majority shares in the country, while retaining, at the same time, their decisionmaking power in investment and technology matters. An extremely small amount of foreign capital, supplemented by a tiny share earmarked for a chosen few, generally people of the same origins but Brazilian citizens, can be sufficient to have a majority.

By prohibiting the parent company-subsidiary sales, the law also prohibits all registration with the INPI, which in turn, blocks all possibilities of seeking protection for the technology from this institution. This absence of protection for technology does not appear to be a restricting factor for transfers, because the companies have to handle their mutual competition and, in that sense, are even condemned to progress; but at the same time, each of them has a tendency to close up, to withhold its secrets rather than eventually sell them—even if, sooner or later, everyone knows them through channels which lie beyond the na-

tional boundaries. It seems that the practice of laying of engineers between competing companies is not delinked to this legislative measure.

One can raise some vital questions: does this have a pernicious effect from the standpoint of dissemination, and innovation of technology, because the State is meant to encourage appropriation of technologies on its territory? Does it mean that by allowing technology sales between the parent company and the subsidiary, or by making it compulsory, the legislation will hasten the progress of technological dissemination? It does not seem to be the case because one can register with INPI in an opaque manner (black box), an opacity which lasts sufficiently long to avoid running into competitors.

In fact, the law called "National Similar" prohibits import of all such technology which can be found in Brazil. Each demand for import is advertised, and any company claiming to have the capacity to supply the same product or process, can raise objection to this demand. The multinational subsidiaries could be affected by this because their technology does not necessarily come from their parent companies. The deadline for the instruction files is sufficiently long, but the development of the national technological network gets a fillip.

Thus, the legislation makes the subsidiaries confront the parent companies by reducing their capacity to take action (seeking finance) on the national territory. Even if the foreign companies, generally speaking, are well treated in Brazil (profits up to 12% of capital can be repatriated annually), this factor can make the subsidiaries feel strangers in Brazil, and make them either withdraw before the parent company or work out strategies of changing their image.

THE STATE AS A CLIENT

The massive construction programme, inaugurated in the Kubitscheck period (1950-55), was given a new impetus in the late 60s with the building of some twenty big barrages, within a span of 15 years; these changed the energy map of the country. PUM can be seen on virtually all the sites, supplying turbines, valves, penstocks, control motors, rolling bridges, and controlling systems. By virtue of its experience in the field, it led the consortium of companies working on a site four-times in the early 80s.

The negotiations between the Brazilian State and the French companies involve the French State which backs its own companies (as other countries do their own) by granting loans to the Brazilian Government. PUM jointly intervenes with IBHY which has the hydraulic technology for the big barrages, and even when PUM is the head of the consortia, IBHY stands by its side. The technology policy of the Brazilian State is thus defined by two contradictory needs: (i) IBHY transfers its technology to PUM, and (ii) IBHY, in the last instance, controls the installations. The indirect pressure on the part of the State can manifest itself at the time of signing a contract, when, for instance, it demands that PUM install a hydraulic laboratory in Brazil.

One can thus observe that a Client-State applies the criteria of a Legislator-State. However, it may be stated at the outset that its interventions are not too frequent, and take place over 10 years after the execution of successive contracts. The PUM-IBHY relations are thus located in this context. In what follows, tracing the history of collaboration between these two companies in the institutional context of IBHY in France (which has undergone some changes), the evolution of cooperation between PUM and IBHY, in each sector, from manufacuring to conception is described here.

PUM/IBHY AND PUM/SVP: TWO FORMS OF TECHNOLOGICAL COOPERATION

PUM/IBHY. "PUM IS THE CREATION OF A MANUFACTURER (SIDER) AND HAS REMAINED AS SUCH".

The meaning of this common expression depends on who utters it. For the Brazilian engineers who accept PUM's manufacturing qualities regardless of their criticism that no transfer of technology was made in the field of hydraulic designing, it means that PUM did not know how to go beyond its task and demand IBHY to transfer its know-how in this domain. For the French engineers, those of CASP, it means that they have done their part of the job of

transfer, and that IBHY, on its part, did not want to do it. For the French engineers, those of IBHY, it means that the PUM never had the capacity, nor did it ever want to possess the financial and human resources needed to accomplish this task. Each group, which analyses transfer from its own standpoint, gives its own version of truth. In each case, there is a company, or professional patriotism which finds its own quality of work implicated in the question of transfer of technology, regardless of the fact that their strategies might have been different. The current relevance or the seriousness of this issue is shown by the fact that the hydraulic laboratory in question was never set up, even though its lay-out has been exhibited in one of the rooms of the Study Bureau, and that everyone has wondered who, or what, went wrong in the decision-making process. While all this has been going on, a Brazilian competitor has begun setting up his laboratory. In PUM, as also in IBHY, a guestion hangs in the air: did we make the best choice for future planning?

This question, raised here contextually, underpins systematically the relations between the different collectives involved in the act of cooperation-not in terms of the choice of each strategy which might be decisive for a collective endeavour but as a need, for each of the groups involved, to find a professional morality that could guide their work relations and communications. The contracts are essentially techno-economic, and can not forsee everything: one can observe the extent to which the relationship between a parent company and its subsidiary in Brazil depend on informal factors. Therefore, one must proceed bearing in mind that technical development and technology transfer are never autonomous, but always the product of a social relationship.

PUM/SVP

The case of applied hydraulics is different from that of the turbines. The manufacture of valves, locks, pumps, carries less technical and economic weight than the turbines, but the problem does not lie at this level. The applied hydraulics is controlled by SVP which is in the same group as IBHY since 1968. Unlike IBHY, SVP designs

but does not manufacture, or manufactures little. One could thus imagine that the control of design for such companies is a more crucial issue. But one finds that it is the opposite phenomenon that reveals itself: over roughly 12 years, SVP transferred all its design technology to PUM. The latter even manifested a real desire to acquire it. SVP could even have refused this process, especially when exchange, outside specific contracts, largely takes place along informal lines-against a technology that BVS gives, slowly but without hesitation, depending on the PUM Study Bureau Chief's visits to France, only promises of information (fulfilled later) on the new markets in Latin America.

What really marks this process is the SVP culture. For the Study Bureau engineers, who comprise majority of the company's personnel, the constitution of an equal network is in the short term a more useful investment from the professional standpoint than retaining know-how from the economic standpoint. Amongst the benefits, there is the professional interest of a future collaboration. This pertains to all the cases of maintenance of the installations. If SVP has to travel (and it is certainly not for trivialities) one cannot ignore the experience gained from the functioning of installations spread all over the world. An intellectual stimulation lies within this process to accept the challenge that the collective will be capable of innovating in future, and that it is part of the job.

This differentiates the SVP culture from that of IBHY. The latter, even though it operates globally as much as the SVP, is above all the approved supplier of EDF which provides it with a captive market, by virtue of being the main designer-manufacturer of the French hydroelectric equipment. Its collaborations with the foreign countries are underlined by this practice: on the one hand, the routine of a quasimonopoly supplier, linked to Brazil by the fact that it is France which, in many cases, provides loans to the Brazilian State; and on the other, an association between designing and manufacturing which is at the root of an attitude that manufacturing, less prize-worthy, can be delegated, but not designing.

MODALITIES OF PUM/IBHY COOPERA-TION

The process of transfer and technological innovation in each sector of production by analysing the results of cooperation between work collectives is examined below.

METAMORPHOSIS IN TEACHER-TAUGHT RELATION (A FRENCH ENGINEER)

Both from the PUM and the IBHY side, the soldering sector is very satisfactory. "The pupil has overtaken the teacher", some say, while referring to their case. At the beginning, the "quality-oriented" mind of SIDER concretised itself through the CASP personnel, placing themselves at the helm of affairs of PUM, and by regularly sending French engineers and technicians to take charge of the soldering section. In 1979, this concern to improve the quality led to the setting up of a soldering laboratory, meant to experiment with new processes worked out in France or elsewhere in the world, and to adapt them to the different types of Brazilian steel which are not the exact equivalents of those in France. Right from this period onwards, PUM was kept constantly up to date in this sector. For four to five years, the heads of the soldering section were French, then a Portuguese engineer, and finally a Brazilian engineer since mid-87. Moreover, the various institutional changes in PUM mentioned above did not affect the process of transfer, perhaps because of the existence of a public strucure of training in France-the Institute of Solderingwhere the French engineers and then the Brazilians undergo training courses. But behind this success was CASP's concern for quality and its own reputation, relayed by IBHY, worldover.

As regards the question of the sluggishness of transfer of technology, it can be seen that soldering technology is a crucial point for hydroelectric power stations, all faults leading to the stoppage of a turbine and long and expensive repairs.

Nonetheless, a little after the soldering section was taken over by a Brazilian engineer, the conception of work changed. It seemed that the work culture which characterized the solderers and the coopersmiths individually, was insufficient to resolve the problems of productivity (high le-

vel of rejects) of the workship. After a training stint at a soldering equipment firm (Lincoln) in the US, the Brazilian Engineer started a programme of "socialisation of technical culture" which aimed at establishing communication between the solderers, and between the solderers and the coppersmiths-all done with the perspective of reducing the levels of rejects. The individual traits of each of them were thus expected to surface, and only those would be retained which were compatible with the objectives of quality and efficiency. The usual conflicts between the solderers and the coppersmiths would thus be considerably reduced, and some spare-parts (grooves, the main part of the generator), hitherto not manufactured by PUM, would now be done.

This question of productivity arose at a very specific moment-at the end of the big barrages period-and remained until PUM, by virtue of its export credits, had either a captive or a low-competition market. Subsequently, it had to switch to other areas of tougher competition, e.g. manuand maintenance of different facturing types of industrial equipment, particularly for the steel and petrochemical industry. One comes across this question later also. It suffices to remark that, in the search for productivity, PUM used an autonomy which it already had, though it had not yet felt the necessity to draw on it. This experience will later prove to be exemplary, because the Brazilian engineer in-charge of soldering would be attached to the Methods Department of work, jointly with others, on the processes of rationalisation.

DEMAND-SUPPLY DETERMINANT OF LEARNING (A BRAZILIAN ENGINEER)

There is an unanimous opinion in another sense in the field of mechanisation on the other hand. If today, PUM has genuine skills in mechanisation, there is no productive appropriation of the processes. The reason, mentioned earlier, lies undoubtedly in their lack of interest in productivity, which must be supplemented with the low cost of manpower. However, the Brazilian competitors are at the same level, and PUM does not have a comparative advantage on this score. It is then the lack of competition in the market that explains the lack of interest in productivity.

Mechanisation is also a different job: it is more about reducing and shaping matter than creating it. It is an auxiliary activity in the CASP tradition, less respected than a solderer's or a coppersmith's work. Moreover, given the lower level of Brazilian equipment as compared with the French. the practice was to send such engineers to take charge of the "Methods and Processes" section who were more mature. and experienced, thus capable of finding solutions to the situations fraught with incertitudes more than is the case in France. The young, less experienced engineers. who, on the other hand, might have had a more modern vision of mechanisation were not sent. Lastly, the development of the digital control in the 70s coincided with the drop in CASP's activities, and whilst IBHY was successfully negotiating this turn for itself, it did not in the beginning want its subsidiaries to have the same know-how. PUM, from its own standpoint, had noticed its inadequacies in 1982, the final year of the signing of the last two big barrage contracts and had demanded from then onwards a larger aid and "new" engineers in this field. This demand was fulfilled only three years later, and the time required for changing habits and work methods implied that it is only now that the computerization of the range of machining tools, or even a systematic classification of the processes and methods used, is taking place. PUM now recruits Brazilian engineers, entrusted specially with the task of modernising the company in this field.

With this general framework, one can understand why both sides did not show concern for a more rapid modernization. Forecasts and planning are done on a short term-basis rather than on medium- or longterm. However, the demand made by the technology-received side triggers off a dynamic between the giving and the receiving party that can be illustrated by the following instances.

Product technology is always spelt out with detailed specifications in formal contracts, whereas the process technology is more informal. This can be interpreted in two ways—either as confidence shown by the parent company towards its subsidiary, or as fear on the part of the former to excessive autonomy to the latter aive which could eventually become a competitor. Matters are both simple and complicated. They can be summarised thus: the technology-giver gives what he can give, and that the receiver is capable of demanding; the receiver accepts what he can accept, and that the giver can give. This interpretation is valid for the details or the examples taken in the general context where two work collectives are involved in an act of cooperation. It indicates that a certain quality of relationship can exist in the cooperation between two work collectives which, in an exemplary case, meets the needs of the collaborating parties, and shows the method to be used for improving this cooperation.

When a mechanisation process is being installed on the three axes of the main vanes of a turbine, the parent company sends an engineer who comes with a programme on a perforated strip. His work is only to install the programme. The Methods engineer of PUM refuses to use a programme because he knows nothing about its conception. When the first engineer does not want to, or cannot, give the required explanations, PUM demands that a second engineer be sent to modify, if need be, the programme, so as to suit its future needs. This event is seen as a positive step from both sides as a mark of a certain code of work morality. But even in this case, the condition still was that the receiver could demand and the giver, give,

A similar problem crops up in the context of internal relations between sections of the technology-receiving company. This problem is, often, related to the type of division of work which defines the parent company/subsidiary relations. It is at times difficult for the "Methods and Processes" division in Brazil to work out a work programme which can reconcile the technical and productivity requirements of the project. Therefore, the task falls on the Manager of this Division to work his way upwards, a procedure which is not necessarily frequent in a compnay, even less when the licensing company and the manufacturer are two different companies. Generally speaking, the "hierarchical culture" is an impediment to technological innovation and

its dissemination, whether it be inside the company or between two companies. According to the French engineers in Brazil, it is more well-entrenched in Brazil than in France, although one must not lose sight of the fact that the intensity of informal personal relations can often dilute the formalism of hierarchical relations. This arises from a similar process as mentioned above-if one dares not demand what one must, (in this case, explanations about upstream matters, from mechanisation to methods, from methods to bureau study), one can not have them.

Last example on the subject of productivity can be thus seen: There exists in PUM, or until very recently existed a secret practice of cost prices-of products, of hourly cost of machines, of wages. This practice is differently interpreted: viz. apprehension that the competitors might find out the cost price and work out more competitive prices, fear that the workers might use their knowledge of the hourly cost of machines as an argument to seek wage-hikes, a concern of quality replacing productivity. Whatever be the interpretation, one thing is certain: there is neither integration nor interaction between the manufacturing, the methods and the finance divisions. Thus, even if there is some steering mechanism, in the top hierarchy, right at the beginning, he gets rid of all culture of technological appropriation inside the receiving company, given that the term "technological" is used in its widest sense-as a technology of product, process and management. Good informal relations between human beings cannot suffice to create this kind of integration.

RESEARCH-DEVELOPMENT-THE LOGIC OF "HEAD" AND "GUTS"

Mechanical design depends on the hydraulic design which gives form to the turbines. This form is defined by a set of interdependent points which, before bearing any pressure, must have some resistance. The basic studies are carried out in France, and the detailed ones in Brazil. The basic studies cover matters related to the dimension and the designs as also the technical specification which depend, on the one hand, on the availability of raw materials and, on the other hand, on

manufacturing constraints. The detailed studies further specify the basic studies, adapt them in light of the supply and manufacturing constraints at the place of manufacture (a slightly pejorative term "tropicalisation" is often used), rework the unified design and carry out the necessary adaptations.

In the opinion of some French engineers of the Studies Bureau who worked in Brazil before returning to France, the detailed study has to be done on the basis of the same principles as those which underpinned the basic study. The detailed study must logically and naturally lead back to the basic study-one only needs to have more powerful means of computation. According to the others, Brazil does not lack any theoretical knowledge, but She is weak in technological knowledge.

It appears that PUM has been preparing a detailed study for the last ten years; it is largely based on the supply and manufacturing, thus technological conditions. The Brazilian State demanded in 1973-74 that the detailed study be performed in Brazil. This demand was partly fulfilled, since the final verifications of all that were put toaether by PUM were supervised by IBHY. It is difficult to say whether this was due to an "informal" demand of the State which is also a client, or IBHY did not want to take any risk. For the first time in 1990, following a private order, IBHY no longer supervised PUM's detailed study. Besides, PUM's official programme proclaims that the engineering expertise required for detailed studies will be finally acquired by 1991, when the Study Bureau will take over the basic studies.

The Brazilian engineers are convinced that the detailed studies are no longer a mystery for them, and that they will be able to develop the basic studies. At the moment, a French engineer heads the Study Bureau (Turbines). The question of acquiring technology, however, does not give rise to any serious debate. Every thing takes place as though PUM had already acquired technology, even if the heads of the Study Bureau are successively French. On the other hand, the debate on the transfer of a hydraulic laboratory to PUM is far from over. If that had been done, it is obvious that the mechanical basic studies would have been carried out in Brazil.

The discussions on installing a hydraulic laboratory have taken place since 1974-75. Towards the end of the 70s, CASP promised, or suggested, to instal it. Its construction was finally programmed when a contract was signed in 1980; its cost was 10% of the contract. Ten years later, no one really remembers the correct figure, but every one feels that it was zero or much less than 10% (as though its cost had been overvalued) as though every one, Brazilian or French, was regretting the lapse.

For IBHY, it was almost impossible to withstand the pressures of the Brazilian State, given the number and size of contracts that it had obtained over the last ten vears. At the same time, in none of the eleven countries where it has set up subsidiaries or joint ventures, some of whom are extremely reputed for their technical skills (Canada) or technological nationalism (India), it has set up a hydraulic laboratory. For the company, this is a matter of defending the very core of its profession, which is the root of its respectability and pride, as also the secret of its innovative skills. At the same time, the argument that installing a laboratory abroad is non-profitable, is not wrong: for similar reasons, Canada retreated before such an investment; IBHY has designed 2665 turbomachines (since the 30s) and installed them in 58 countries, and all from one single laboratory.

However, the laboratory was not set up, as was the case with some other things in the contract, because the Brazilian government did not pay. This official reason can not be refuted. It must, however, be noted that each one blames the other for not having helped in its creation. This issue has really acquired relevance today; now that a Brazilian competitor is constructing a laboratory, it is "strategic mistake", say many Brazilian engineers, some of whom have been approached by this competitor. The fact that the latter is more an electrical than a hydraulic engineer has some, predict his failure; but the process, however, is on, and the Brazilian and the South American market is still full of potentialities, even if there are problems in

the short-run. Lastly, the Brazilian government has all the legal means (National Similar Law) to assist a domestic company compete with a multinational.

This was, however, not the first experience for IBHY and PUM in this field. For, a few years ago, the same competitor had attempted to bring together the different parties (based in Brazil, domestic or others) on the sites of the big barrages initiated with the assistance of the state "techno-structure" and had failed, and ended up in the creation of a foundation, financed by the same parties, and affiliated to the University of Sao Paulo. Controlled by the latter, and the product of a failure. this foundation exists in a state of fair inertia. PUM tried to go beyond this experience in 1987 by creating a laboratory in conjunction with the University of Minas Geraes to design small turbines. Another compensation was the installation of a department of regulation at PUM, until now under the control of IBHY. These compensations, which resulted from the absence of a programme of technology transfer, despite the termination of the big barrages construction programme and the existing recession, etc., have not managed to remove the bitter taste present among all the actors at present in Brazil. A technological adventure was at one's arms length. and everyone was ready to be involved in it. This also made them remain leaders in Latin America in this field. This episode demonstrates both the power of the dvnamic of cooperation, strongly supported by the Brazilian government, and its powerlessness in the face of questions of strategy. The French side presents it as a contradiction between two forms of logic-that of the "head" and that of the "guts", but viewed from the Brazilian side, this could be inversed to assert that the "head" was Brazilian and the "guts" French. What would have happened to it if the Brazilian government had paid?

ROLE OF INTERNAL COMPETITION

By regulation is meant the system of maintenance and control of a power station-maintenance of the oil station, functional engineering (control of starting and stopping sequence, monitoring of water flow, of the cycle, of power), and the elec-

tronic regulation of the assembly. Despite a long-standing grievance against the French, a Brazilian engineer was sent to France in 1987-rather too late, from a technical standpoint-with the mission of setting up a regulation service on his return. Barely had he got back then he found another competitor who was busy working on a similar project. A second engineer was sent for a shorter duration, and with the more limited objective of learning to run the after-sales service and of manufacturing some elements of the mechanical part. Finally, a French engineer arrived in 1990 to locally put together all elements needed for the running of a regulation system-looking for materials, manufacturers, and for setting up the assembly. It seems to have been a serious decision since before leaving France, this engineer, who had already worked in the regulation department of quality control, was trained in all services of the department. This decision appears to have been taken so as to make up for the lost ground vis-a-vis a competitor who had started off earlier. Again, this decision was presented as indispensable, given the high import duties on electronic and computer equipment, but these duties have existed since long, and these were not the determining element in making this choice.

This example clearly shows that the process of technology transfer depends largely on the existing level of competition in the receiver-country; it also indicates that the companies have some difficulty in holding back their technical know-how in a context of stiff competition, and when the collective or individual competence of the others are unknown or uncertain. Hence, the tendency of each company to close up, and fall back particularly on its national companies in the case of a multinational. It is in this sense that the presence of French heads of service in many sectors of the company must be understood; it does not imply that technology was not transferred to the local engineers, but that great importance is attached to how information is controlled and divulged.

Perhaps too much must not be made of this phenomenon of "brain drain" between the national competitors, in the sense that within the social group of engineers and, more generally, in the industrial circles, there exists a particular culture called "immediatism". None is quite sour of its origins, and it seems to have developed with the industry. Basically, from an individual's standpoint, it implies the readiness to seize-if need be, by "bluffing" whatever opportunity or immediate gain that comes his way regardless of the long-term benefits.

Be that as it may, what is certain is that at the base of it lies the management and human resources policy of the company, which leads us to study a new aspect of the problem of transfer of technology. The term "management", in this case, refers to two issues-first, the division of work between the parent company and the subsidiaries, and their respective integration into a system of work and representations acceptable to all; and secondly, the organizational and management system of the subsidiary and its evaluation of its own competence to modify, and thus innovate, through its relation with the parent company-the latter is always considered to be "more advanced", and in a position to indicate the general rules for the healthy functioning of the organizations.

PARENT COMPANY, SUBSIDIARY AND MANAGEMENT: A LARGER CONSENSUS ON AN INTERNATIONAL SCALE?

The creation in 1988 of the "IBHY Network" answered a dual necessity: first, of maintaining regular, formal, almost solemn information and exchange relations at the highest level (with the four directors of the twelve industrial units in the world), so that each can find his progress reflected in the development of the entire company; secondly, of setting up an integrated system of R&D, in which each country will have its share (complementary to that of the others) in a coherent international system.

The network met for the first time in 1989, and it will be premature to speak of its work perspectives. Its first findings may be quite unpredictable, as they arise out of a new context. However, if the strategy of the Centre, which until now was the only one taking decisions on "private" negotiations with each of the subsidiaries, favours greater integration or collective decision-making, one can expect that each of the local-national cultures will be modified by it.

It is expected that the international production division will be better organized, integrated, and that each subsidiary will be a little less dependent on the local-national market. But for this, it must at first give proof of its competitiveness within the group, and then, if need be, align itself along the strategic choice proposed to the Centre. Even if it is left to the subsidiaries to decide on their means (manufacturing processes and style of management), the idea of a greater mobility of engineers between the subsidiaries (only the Centre engineers, or all of them?) augers a greater uniformity of management.

In the field of R&D, it seems that there will be minor modifications. As opposed to decentralisation, the tendency is to concentrate R&D in the central cities, if required in the form of partial cooperations between multinationals. This will leave behind only a few traces for specific projects, and that too of little importance.

Given several factors like the gap that can always exist between thoughts and reality, the incertitude of the final outcome of projects even though they might have risen out of identical strategies and the newness of projects, it is not easy to give an answer to the question: can the ongoing integration strategy forge a group consensus on an international scale? Is it, on the other hand, likely to instigate the process of getting rebuffs from the Statebacked national industrial cultures whose concern is to indigenise knowledge and technology, and not just its applications and organizational models?

THE SUBSIDIARY: AN ORIGINAL OR STANDARD MANAGEMENT?

The question of management came up recently, several years after the crisis of the "big barrages" production model. This delay can be explained by the fact that the company had to look for new areas of production and could not think of reorganising itself without knowing what it was going to produce. While analysing the manufacturing sector, it was observed that an organizational culture gradually superimposed itself on a job-oriented culture. The variety of new forms of production that came into being, added to a drastic reduction in personnel (3200 employees in 1982 and 950 in 1990) led logically to a demand for transferring parent company's organizational technology to the subsidiary.

This demand came rather belatedly only after several visits by French production experts, and when many Brazilian engineers, who had collectively started modifying the work system in their sector, had been promoted. But this was still not enough. A more systematic reorganization was needed. This was done-and the timing is not unimportanta little after the last great wave of retrenchments in April 1989. It was at this time that a French organization consultant, who was suggested and indicated by the parent company following a demand from PUM, was called in.

The consultant conducted an "audit" with the help of a group of five Brazilian engineers, each of whom was in-charge of a field, though not its experts. Given the objective, the group was set ("to obtain an internationallevel productivity") on the basis of a wage/ turn-over ratio. Their conclusions seem to be almost the same as those in the West-meraing of the work methods, using computerization to reduce the weight of bureaucracy, definition and programming of medium-term targets, succinct analysis of work, reduction in the levels of hierarchy, elaboration of a company's project. Visits to the TOMALO group companies became a regular feature for the Brazilian head of the group. A real exchange took place between the latter and the Advisory Board which, being above the company's hierarchical structures, slowly perfected the propositions and introduced the changes. A reflection of the new times-the Director (Industry), in-charge of these radical changes is. for the first time since 1954, a Brazilian (January 1990): besides; this is the first time that an administrator, instead of an engineer, has been asked to take over this charge. His aim is to "make the company walk on its own legs, and advance, without losing its balance, on all fronts".

This significant change of perspectives goes hand in hand with the creation of three posts of "Project Managers" who, after the signing of the contract with the client, are assigned the task of supervising the manufacture of a product in the factory, of ensuring the company-supplier coordination, of having a product delivered in required time and to look after the after-sales service until the period of guarantee is over. This is an attempt towards "just in time" production in small batches, something which would have been impossible without prior rationalization of the work process.

Finally, Brazilian engineers will no longer be recruited, as was the case until now, from the

regional colleges, known to be average. Since they can not guarantee a relative stability in supplying such skilled manpower, the recruitment will now be done from the distinguished colleges of Rio and Sao Paulo. There will be systematic training programmes at the time of joining the company; vivid perspectives of career will be offered; and in order to combat the problem of engineers fleeing at the end of training programmes, more than the required number of engineers will be recruited. These changes, added to the new salary structure for the engineers (implemented in 1988) permitting the Study Bureau engineers to have the same salary as those in the production section, will help to settle down this section of the personnel. This will also help resolve the problem of capacity of technological appropriation, which was the pretext on which IBHY justified its hesitations in matters of technology transfer.

In the last instance, NEM, the German share-holder, will be contacted again, particularly for the machining section for which it has an uncontested reputation.

These measures, largely inspired by the organizational and management techniques that have been successful in the West, do not imply an excessive dependence of the subsidiary on the parent company. In fact, a greater autonomy seems to result from it; it remains to be seen though, how this autonomy can function within the framework of the new strategies put into operation by the parent company?

PROFESSIONAL ETHIC AND PRODUCTIVE ETHIC

This evolution of relations between the parent company and its subsidiary could be summarised thus: at the beginning, an agreement is signed in which the parent company's position is all-powerful and its strategy, the determining factor (quality of production). Following that, the subsidiary makes a demand for transfer, and the parent company answers it in terms of its capacities and strategy.

The subsidiary does not live in splendid isolation and its surroundings (Government, competition) affect its behaviour. However, the surroundings do not directly affect the company as they would as a whole; it mediates through certain social groups that are present within it. The latter themselves find a mediation in the cooperation collectives which have come to exist between the parent company and the subsidiary. This dynamic can lead to influencing the subsidiary company's decisions on the new agreements between the parent company and itself; it can also be blocked at this level. But it does not stop from existing, as it renews itself constantly, and strives for better and more balanced relations between the two partners. This dynamic is understood by the parent-company which attempts, by addressing itself to this professional ethic, to orient it towards a productive ethic, while bearing in mind the changes in its own strategy which link the need to pay more attention to the local partners' autonomy and a more intense division of work.

SUMMARY

This paper studies long-term transfer of technology between the parent company, namely French and its subsidiary in Brazil. Highlighting the conditions of transfer as stipulated by the Brazilian legislation, and the role of the State as a client of the subsidiary company, it analyses the various activities of the technology-receiving company (production, R&D, and management), It also examines the results of the cooperation between the two parties, and seeks to point to the reasons for their success or failure. The work culture of the two companies, the technological policies of the parent-company and the technology-receiving State, and the competition in the latter are the various factors that help us to comprehend the reasons behind success or failure. These factors, however, express themselves through the act of cooperation between the work collectives of the technology giving/receiving countries. During the course of development cooperation, a professional ethic is born, itself the spirit behind transfer and innovation. One can thus sociologically analyse the new strategies of integrating the multinationals which use this ethic to direct it towards a productive ethic, wherein the indigenous partners enjoy greater autonomy, and with an intense division of work. The hypothesis can thus be advanced that the dvnamic of the cooperation collectives will continue to be based on a renewed professional ethic.

NOTES

Antonio Jose Botelho, Computers, a Third World Country Builds its Own, *Technol Rev (MIT)*, (May-June 1987) pp 36-45.

regional colleges, known to be average. Since they can not guarantee a relative stability in supplying such skilled manpower, the recruitment will now be done from the distinguished colleges of Rio and Sao Paulo. There will be systematic training programmes at the time of joining the company; vivid perspectives of career will be offered; and in order to combat the problem of engineers fleeing at the end of training programmes, more than the required number of engineers will be recruited. These changes, added to the new salary structure for the engineers (implemented in 1988) permitting the Study Bureau engineers to have the same salary as those in the production section, will help to settle down this section of the personnel. This will also help resolve the problem of capacity of technological appropriation, which was the pretext on which IBHY justified its hesitations in matters of technology transfer.

In the last instance, NEM, the German share-holder, will be contacted again, particularly for the machining section for which it has an uncontested reputation.

These measures, largely inspired by the organizational and management techniques that have been successful in the West, do not imply an excessive dependence of the subsidiary on the parent company. In fact, a greater autonomy seems to result from it; it remains to be seen though, how this autonomy can function within the framework of the new strategies put into operation by the parent company?

PROFESSIONAL ETHIC AND PRODUCTIVE ETHIC

This evolution of relations between the parent company and its subsidiary could be summarised thus: at the beginning, an agreement is signed in which the parent company's position is all-powerful and its strategy, the determining factor (quality of production). Following that, the subsidiary makes a demand for transfer, and the parent company answers it in terms of its capacities and strategy.

The subsidiary does not live in splendid isolation and its surroundings (Government, competition) affect its behaviour. However, the surroundings do not directly affect the company as they would as a whole; it mediates through certain social groups that are present within it. The latter themselves find a mediation in the cooperation collectives which

have come to exist between the parent company and the subsidiary. This dynamic can lead to influencing the subsidiary company's decisions on the new agreements between the parent company and itself; it can also be blocked at this level. But it does not stop from existing, as it renews itself constantly, and strives for better and more balanced relations between the two partners. This dynamic is understood by the parent-company which attempts, by addressing itself to this professional ethic, to orient it towards a productive ethic, while bearing in mind the changes in its own strategy which link the need to pay more attention to the local partners' autonomy and a more intense division of work.

SUMMARY

This paper studies long-term transfer of technology between the parent company, namely French and its subsidiary in Brazil. Highlighting the conditions of transfer as stipulated by the Brazilian legislation, and the role of the State as a client of the subsidiary company, it analyses the various activities of the technology-receiving company (production, R&D, and management). It also examines the results of the cooperation between the two parties, and seeks to point to the reasons for their success or failure. The work culture of the two companies, the technological policies of the parent-company and the technology-receiving State, and the competition in the latter are the various factors that help us to comprehend the reasons behind success or failure. These factors, however, express themselves through the act of cooperation between the work collectives of the technology giving/receiving countries. During the course of development cooperation, a professional ethic is born, itself the spirit behind transfer and innovation. One can thus sociologically analyse the new strategies of integrating the multinationals which use this ethic to direct it towards a productive ethic, wherein the indigenous partners enjoy greater autonomy, and with an intense division of work. The hypothesis can thus be advanced that the dynamic of the cooperation collectives will continue to be based on a renewed professional ethic.

NOTES

Antonio Jose Botelho, Computers, a Third World Country Builds its Own, *Technol Rev (MIT)*, (May-June 1987) pp 36-45.