

**TECHNOLOGY TRANSFER  
TO DEVELOPING  
COUNTRIES  
BY SMALL  
AND MEDIUM-SIZED  
ENTERPRISES**

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# **Technology transfer to developing countries by small and medium-sized enterprises**

by  
J. Campos, J. Cardozo, A. Herrera,  
E. White, and M. Sierra

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INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

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## PREFACE

*In memoriam Eduardo White*

This report presents the results of a multicountry research project aimed at understanding the phenomenon of the international transfer of technology to developing countries by small and medium sized enterprises (SMEs) based in developed countries. The study, which was supported by the International Development Research Centre (IDRC) of Canada, was coordinated by the Centro de Estudios de Desarrollo y Relaciones Económicas Internacionales (CEDREI), Buenos Aires, and benefitted from the contributions of 12 research collaborators in both the transferring and recipient countries.

From its very beginning the research project was conceived and promoted by Eduardo White, Director of CEDREI at the time. In fact, White devoted many years of his academic career to the study of the internationalization of SMEs, and was the responsible of carrying out the first phase of this IDRC-funded project (White and Campos 1986). He selected the team of 12 researchers that worked on the present survey, and organized their three meetings in Nuremberg, Montreal and Buenos Aires. These gatherings were extremely useful for improving the accuracy of the research approach as well as for the carrying out of the field work, and for the discussion of the main findings that came out from the different country studies (the respective papers are included in other two volumes: CEDREI 1990 Vols. I and II). Furthermore, prior to his death White was also responsible for previous drafts of certain sections of the present report.

For those of us who had the privilege of working during many years side by side with him on this line of research, his disappearance was a great blow. His enthusiasm, sharp mind, auto-criticism and deep respect for his colleagues points of view made the daily experience of sharing a research endeavor with him an extraordinary gratifying as well as joyful adventure.

It is a satisfaction then for us to dedicate this report to his memory.

## ACKNOWLEDGEMENTS

Our first word of gratitude is, of course, to the International Development Research Centre (IDRC) of Canada. Throughout its implementation the Centre's support was crucial for the project to be carried out successfully. From the professional staff of IDRC, we wish to acknowledge the permanent advice and deep interest in our study of Amitav Rath, Eva Rathgeber and Brent Herbert-Copley.

We would also like to express our appreciation to our developed country-based research collaborators who were actively engaged in the project, sometimes having to follow very tight directives and schedules without any compensation at all but that of participating in a common endeavor. Their role was decisive, since they were responsible for the interviews to the small and medium-sized enterprises as well as for the elaboration of the individual country studies. The referred colleagues are:

- Dr. Brij Kumar and Dr. Horst Steinmann, authors of the paper on the experience of the German SMEs studied in this project. They also were responsible for hosting the first meeting of the group at the Friedrich Alexander Universität in Erlangen, Nürnberg.
- Dr. Jorge Niosi, who contributed with a paper on Canadian SMEs. He also played host of the second meeting of research collaborators at the Université du Québec à Montréal.
- Dr. Michel Delapierre, who wrote the paper on French SMEs.
- Profs. Fabrizio Onida and Gianfranco Viesti. The latter co-author of the paper on Italian SMEs.
- Prof. Terutomo Ozawa, author of the paper on Japanese SMEs.

- Profs. Peter Buckley and Hafiz Mirza, authors of the paper on United Kingdom SMEs.

- Dr. Tomás Kohn, co-author of the paper on United States SMEs.

Also important was the role of the team of colleagues dedicated to the recipient developing countries since they were responsible for the field work as well as for the preparation of the respective country papers. The referred colleagues are:

- |                        |   |           |
|------------------------|---|-----------|
| - Prof. Afonso Fleury  | - | Brazil    |
| - Prof. Ashok Desai    | - | India     |
| - Prof. Won Young-Lee  | - | Korea     |
| - Prof. Miguel Márquez | - | Mexico    |
| - Prof. Pang Eng Fong  | - | Singapore |

A final, albeit important word on authorship. As said, up to his disappearance in January 1990, Eduardo White was the main research coordinator of the project and had the opportunity of drafting parts of what are, in this report, Chapters II and III. From there on, the undersigned assumed the responsibility of editing this final report and of elaborating the Introduction as well as Chapters I, IV, and VII. In this task he was very much helped by Javier Cardozo (responsible for Chapter VI) and Alejandra Herrera (co-author of Chapter II).

Marcelo Sierra greatly contributed in his role of junior researcher with his suggestions as well as with his work in tackling the difficult job of processing the gathered data. In the first phase of the project Marcela Miozzo also helped us in this activity.

Jaime Campos  
Director  
CEDREI

## INTRODUCTION

Thousands of small and medium-sized enterprises (SMEs) with headquarters in developed countries have carried out, in the last decades, production operations in foreign countries. A not insignificant number of these initiatives have been implemented in developing countries (White and Campos 1986 and Fujita 1990). Notwithstanding, its proper to say that as a whole their presence has been largely unnoticed by scholars and government officials.

To a certain extent this neglect has to do with the fact that a priori the study of the internationalization of SMEs appears as a rather odd subject of analysis. That is, at the light of most of the received literature on the foreign expansion of firms, only large undertakings are considered to be in a position to embark in production projects in foreign countries. Smaller firms, on the contrary, have been viewed,traditionally, as agents for which there is no other proper environment to operate in than the one of their local, or at most national market. The reason is at first sight quite straightforward: the establishment and management of a production venture in a foreign country requires on the part of the firms involved the possession of significant resources which are considered to be out of reach for SMEs.

Is with this background in mind that this Introduction is organized. First, it refers to the antecedents of this subject of study. Through them its possible to shed some light on the main points of view and interests of the research carried out up to now. Second, a look at the received literature on international production and its relevance for SMEs internationalization will be advanced. This presentation will help to capture some of the more crucial features of the latter process. Finally, a word on the contents of the present study will be put forward.

## 1. Some research antecedents

### a) Three broad viewpoints

The studies carried out so far on the internationalization of SMEs can be conveniently grouped in three categories according to their main emphasis. The first ones have dealt with "push" factors of a macroeconomic nature. Research carried out by the end of the seventies in certain European countries and Japan is a case in point.

The main preoccupation in Europe at the time had to do with the restructuring process. In fact, during that period, in those countries there was a growing awareness about the challenge to the competitiveness of certain industrial branches generated by the rise in real wages. In addition, there was a clear perception that the loss of comparative advantage in labor-intensive industries was an structural phenomenon. That is, the main thrust those days was that those industrialized countries had to prepare themselves for loosing out the capacity of producing certain goods which accounted for a large utilization of labor inputs per unit of output. Furthermore, there was a clear recognition that the natural expected path was for those industries to move to those locations in which labor was a relatively more abundant resource. Developing countries appeared, of course, as the natural environment for those activities.

UNIDO's reports conducted in Belgium, Sweden and Switzerland (See UNIDO 1978, 1979a and 1979b) and Halbach and Bohnet's (1976) one on the Federal Republic of Germany, based on surveys to a wide array of firms from different industries, sought to find out their interest in transferring productive resources to developing countries. The common conclusion of all of them was that redeployment appeared as a more attractive possibility for firms in labor intensive industries, but it was in relation with small and medium sized enterprises that the potential of operating abroad emerged as

particularly attractive. In other words, those reports emphasized the strong correlation found between industries that were experiencing a restructuring process and the important presence in them of smaller undertakings.

Kojima (1977) and Ozawa (1979) studied the process of internationalization of Japanese firms and verified that contrary to what was expected from the received literature based on the U.S., and to a less extent European experience, the former phenomenon was largely the result of deep macroeconomic changes experienced by the domestic economy. More precisely, both authors reckoned, that the significant rise in real wages in Japan coupled with the appreciation of the Yen, operated as very strong incentives for firms in labor-intensive industries to move to nearby Asian countries where costs of that factor of production were a fraction of those in Japan.

The interesting observation of both scholars was that Japanese foreign manufacturing investments were carried out by firms placed in competitive industries that produced relatively simple, standardized, traditional goods; and that the common feature of those enterprises was that most of them were of small or medium size. In other words, they demonstrated that in the Japanese experience overseas ventures were to a significant extent the result of SMEs moving away from an unattractive macroeconomic environment to countries with endowments more in line with their competitive advantages.

A second approach followed by some scholars has paid special attention to the role performed by industry as well as firm specific variables. Among others, Kohn's thesis (1988), probably one of the most significant efforts in the field, showed that U.S. SMEs that invested abroad — in tune with much of the received literature — tended to be established in high growth-R&D intensive industries. But he also found that in contrast with the typical pattern depicted for large transnational corporations, SMEs that

got involved in foreign operations were not established in industries — such as the ones that manufacture consumer goods — in which brand names represented an important ownership advantage.

Other studies have shown that SMEs carry out foreign operations in order to maintain their presence in overseas markets previously supplied through exports. The German (Kumar and Steinman 1990) and Italian (Onida 1985) experiences are at this respect very revealing, since the referred undertakings established in them are highly geared towards exports. The decision by them of transferring productive resources abroad appears in many cases as a second best option to assure a presence in a given country that can not be reached otherwise.

In what has been labelled the "second wave" of Japanese SMEs investments abroad, firms of this nationality appear in recent years to have put to work a strategy according to which they gradually displace to foreign locations the manufacturing of relatively more simpler products and continue to produce at home (in contrast with what was usual in the "first" wave) those of higher complexity (Ozawa 1985). This behavior matches the one by large transnational corporations and suggests that SMEs can adopt increasingly sophisticated modes in their overseas involvement.

Finally, a third category of studies have emphasized what can be called "pull" factors — that is stemming from the recipient countries themselves — in order to explain SMEs international operations. In fact, Ouane (1986), Bell and Scott-Kemmis (1988), and White and Campos (1986), have showed that a significant number of the latter experiences were to a large extent feasible due to the crucial role performed by host country firms in the process. The data from these studies indicates conclusively that were those undertakings that contacted the SMEs the ones carried out much of the main activities necessary to make the technology transfer possible. Furthermore, without

the existence of complementary resources (technical and otherwise) contributed by them, SMEs originated know hows would not have been imported and assimilated.

b) The view from the South: SMEs as alternative sources of productive resources

By the end of the seventies, scholars in developing countries were back from a period characterized for a great criticism of the behavior of large transnational corporations, and were increasingly moved by their interest in looking for new agents that could be taken into consideration to derive from them needed productive assets. It was in the context of this motivation that UNCTAD asked E. White to produce a report on the role that SMEs could perform in the international transfer of technology to developing countries. White's paper stands out clearly as the most complete statement regarding those dimensions of SMEs that a priori were considered at the time to be of particular interest from the point of view of developing countries.

According to the referred author (White 1980), those were:

i) technologies controlled by SMEs were considered to be more appropriate to developing countries endowments, given the more frequent use by these undertakings (relatively to large firms) of labor intensive techniques. In addition, the hypothesis was that SMEs know hows were probably more simple to operate and that the fact that they were associated with the manufacturing of smaller production runs, made them more adaptable to the small market conditions of most developing countries;

ii) given their lack of resources and of experience in operating in foreign markets, SMEs were viewed as necessarily more inclined to accept a larger participation of host country firms in their ventures abroad. This preference went hand in hand with the strong motivation at the time on the part of developing countries for allowing their

own domestic firms to have a relevant participation in projects with foreign investors. An involvement of the former undertakings was considered as a useful mechanism to allow them to assimilate the skills transferred and to minimize the negative balance of payments effects normally associated with wholly owned subsidiaries.

iii) the fact that by definition SMEs control limited resources and that the projects in which they may participate in developing countries would be of relatively smaller size, entailed that the probability of them emerging as powerful agents with strong political clout on their own, vis a vis host country governments was low. This was of course viewed as a very important feature of these enterprises inasmuch as in many developing countries there was at the time a strong mistrust of large corporations dealings with local governments.

As it would be evident throughout this study, in due time some of the features of SMEs signalled out by White were not to be backed by his own research as well as by that conducted by other scholars. But no doubt his provocative report influenced other colleagues and established to a great extent the agenda on the topic of what were to be the following research efforts supported by IDRC, UNCTAD as well as by other organizations.

## 2. The received theory and SMEs internationalization

In the standard theory of international production firms move abroad move abroad because they possess certain competitive advantages. This fact puts them in a better position vis a vis domestic firms in the recipient market. Without the control of those attributes those firms would not surpass the obstacles normally associated with an overseas engagement. Typically two main types of assets are here worth referring.

The first one has to do with tangible assets such as financial resources. That is, firms that are capable of mobilizing those assets are better suited to operate in foreign markets. The ones that traditionally face constraints at this respect, — typically SMEs — are considered agents with low chances to participate in such ventures. As Horst (1972) has put it, "investing abroad may entail certain fixed costs which must be incurred if any foreign production is to occur. Because larger firms are often considered to be better credit risks than small firms, large firms may have an easier time financing the fixed costs entailed in investing abroad".

But the above mentioned statement is based on the assumption that the population of SMEs is homogeneous. That all firms of that size face the same constraints and are in an equal footing when it comes to their capacity to mobilize the financial resources needed to go ahead with a production venture in a foreign country. In this vein, it is appropriate to indicate that the studies conducted on SMEs which have actually participated in those initiatives, demonstrate that certainly the most common finding is not that all types of SMEs have an equal share of those ventures. On the contrary, the overall tendency has been to verify that relatively stronger firms — and, thus, presumably with better access to credit — have been more frequently involved in foreign production operations.

The above comment should not be viewed as implying that SMEs, including those that are in a stronger relative position, do not tend to face larger obstacles at the time of mobilizing the needed assets than large firms. For example, the lack of sufficient managerial resources is an important barrier that SMEs face when trying to assess a given opportunity and at the time of actually operating in overseas markets through production activities. In fact, for these firms, it is not easy to find ways to replace the local personnel moved overseas, or to overview the foreign venture's operations. As Buckley and Mirza (1990) have put it, "small firms do not often have

specialist executives to manage their international operations, nor do they possess a hierarchy of managers through which complex decisions can be sifted".

But modern approaches have emphasized the relevance of the ownership of intangible assets as the main factors explaining the internationalization of firms. Dunning (1983), for example, has contended that is the control of firm-specific resources that put multinational enterprises at an advantage vis a vis their competitors. Among the latter, no doubt the capabilities of those firms to master certain technologies has been viewed as a particularly crucial feature.

By and large, the referred argument can also be applied to SMEs. In fact, as it will be underlined in a next Chapter, those SMEs that have got involved in production operations abroad (in this case in developing countries), have pursued R&D efforts usually above what could be considered the average of their industry. In other words these firms appear also to control certain know hows that allow them to control a given advantage when competing in foreign markets.

But the main thrust of the received literature, strongly flavored by the experience of large U.S. firms, has been up to now to emphasize the control of technologies based in the exploitation of scale economies and of product differentiation through significant advertising and marketing efforts. In other words, the possession of other intangible assets by a firm was not usually considered to be a relevant feature inasmuch as they were not viewed as decisive at the time of explaining their overseas involvement.

In particular, the fact that smaller firms may possess ownership advantages derived from their control of very specific know hows, related with the production of goods targeted to satisfy a very limited and, usually sophisticated demand, has not been considered. More so, that smaller firms producing custom made goods could be in a

competitive position when operating abroad was not easily accepted in the framework of theories that assumed that firms that specialized in manufacturing goods tailored to a given local demand, would not be particularly suited to move overseas.

What the received theories did not foresee, was the fact that a firm — typically an SME — specialized in a very specific market niche, would be inclined to operate abroad as an appropriate strategy to maintain its leading position in a given product line. More so, the deeper the commitment of the firm to innovational efforts at its very specific field, the more constraints it will face to operate only in its domestic market. As Gomes Casseres and Kohn (1990) have convincingly put forward, as specialization deepens, SMEs gain from moving overseas. This strategy, in addition, allows them to extend their overall volume of activity and derive a larger income from which they can support their increasingly critical R&D efforts.

As Cantwell (1988) has correctly emphasized, in the literature on multinational firms ownership advantages have been confused to often with monopolistic advantages, following the terminology used by market power approach theorists. No doubt this confusion has helped to put aside the study of SMEs as agents that participate in the internationalization process, since these undertakings are not, normally, in a position to hold those type of features. When instead, the foreign involvement of firms is looked upon as the result of monopolistic competition and rivalry among firms that can be more appropriately defined as oligopolists, then there is much that can be derived from the literature to illuminate SMEs drive towards overseas operations.

In fact, Kohn (1988), Bertin (1986), and others have shown that SMEs that invest abroad tend to control a large share of the home country markets in which they operate. These findings are, admittedly, related with a narrowly defined concept of industry. In other words they usually correspond to specific product lines rather than to

whole branches. Notwithstanding, and in terms of their actual business behavior, this fact entails that these firms command a relatively leading position and as a consequence are in a position of controlling certain specific assets that albeit their small absolute size allow them to plunge into foreign production ventures.

According to product cycle theories (Vernon 1966), innovating firms first export their goods to foreign markets and then, when the products they manufacture enter into a phase of increasing standardization, they set up production abroad as a means to be in a better competitive position vis a vis low cost producers. These theories are structured under the hypothesis that as time elapses the cost of producing a given product tend to diminish as a result of an increased utilization of manufacturing techniques with significant scale economies.

From the evidence so far obtained its possible to state, that in fact in some instances the referred theories can also help to understand the internationalization of SMEs. For example, Ozawa (1985) in his study on Japanese SMEs that moved to nearby Asian countries, emphasizes that one of the motives for them to carry out that decision had to do with their preference for manufacturing abroad those products that could be fabricated through relatively more standardized methods. But its obvious that for SMEs dedicated to the production of custom-made goods that have decided to operate abroad, an interpretation based on the above features is not entirely appropriate.

Among the approaches that have been developed to interpret why firms decide to get involved in production operations in foreign countries, the theory of market internalisation has received wide attention (Buckley and Casson 1971). This body of literature would predict that smaller firms have less reasons to adopt equity controlled forms than non-equity forms of international involvement. The higher risks associated

with the former and the difficulties inherent in managing a foreign affiliate would deter SMEs from adopting that organizational mode.

But the evidence gathered so far indicates that many SMEs particularly when they happen to take the decision in an "autonomous" manner (that is, when they are not approached by a recipient firm with a given project), prefer to use equity controlled forms in their foreign operations. Through them the need to formalize their know hows is reduced and the burden of coordination between affiliate and parent firm is eased, since typically these firms prefer to manage their overseas affiliates (which normally are a small number) as a division of the parent company.

### 3. Contents of the report

The first objective of this report is to characterize those SMEs that have participated in the experiences of technology transfer to the six selected developing countries. More specifically, in Chapter II, the main features of SMEs are presented as well as their international expansion experience. Data on their absolute sizes, relative position in their respective industries and technological behavior allow to grasp some of the structural forces at work that operate to explain their drive towards overseas markets. The previous international involvement and the basic patterns followed at this respect are also analyzed.

SMEs participate in the studied ventures through equity as well as non-equity forms. Chapter III deepens into the factors that explain the preferences of those firms for one or another mode, and also sheds light on the restrictions that these firms face at this respect. Any of the organizational modes selected is strongly determined by the nature of the know hows actually transferred by SMEs and by the channels used. In

order to understand the characteristics of the latter, an analysis is advanced in Chapter IV. More precisely, the evidence on the contents of the technologies transmitted by SMEs to developing countries and the utilization of particular mechanisms such as blue prints and technical assistance is put forward.

Of special interest for developing countries is the issue of the adaptability of SMEs technological assets. This is the main focus of Chapter V, where the data on the extent of prior adaptation and the degree of the efforts carried out at this respect is presented. Chapter VI, on its part, deals with the issue of the significant role performed by domestic initiative-taking firms in allowing the transfer of technology from SMEs to take place.

Finally, the last Chapter tackles the topic of the policy measures that home and host countries could device to promote an increased utilization by the latter of the resources controlled by SMEs. This efforts would allow developing countries to have access to a virtually untapped reservoir of technical resources that can be put to work, in many instances, to the benefit of them.

## CHAPTER I

### METHODOLOGY AND SAMPLE DESCRIPTION

The purpose of this section is to present the different methodological aspects which characterize this research effort, in order for the reader to gain a precise idea of the unit of analysis of the study as well as of the special features of the empirical survey that was conducted. Given the complexities of the research topic as well as of the procedures followed to identify and select the cases studied, the need for a detailed methodological presentation at the outset is crucial for the understanding of what comes below. Thus, the reader is strongly urged to go through this section before reading what comes next.

#### 1. The concept of SME

A crucial aspect of this research has to do with the definition adopted as to what is considered to be a small or medium sized firm. It is obvious that size is a tricky concept inasmuch as a firm may be considered a small firm according to a certain feature and be labelled as a medium-sized firm or even a large firm when looked from a somewhat different perspective. A typical situation arises, for example, when criteria based on number of employees is used together with one on market share. It is clear that a firm may be considered small in one count — let's say because it has a work force of less than 100 employees — but on the other hand control a significant proportion of the market of a given industry narrowly defined.

It is also evident that firms which following certain parameters such as sales could be considered small in terms of, for example, the U.S. market, would be classified as large when compared with the typical firm established in other countries with a much

smaller domestic market. In fact, as it will be referred below, this explains why the criteria used by some U.S. governmental institutions includes size categories which surpass the ceilings typically used by their counterparts in other industrialized countries. What is true at the country level can be extended also to the industry level. Firms whose size measured by, say assets, are viewed as small in a capital intensive industry would normally be looked as large firms in a highly labor intensive manufacturing sector.

The above comments are, of course, also applicable when, as in this report, firms are studied in so far as they transfer technology overseas (in this case, to developing countries). From the received literature we know that the participation of a firm in a venture in a foreign country entails the commitment of resources which are usually less abundant in a small firm. This is particularly the case when firms carry out direct investments abroad since this mode of operation requires the transfer of financial, technological and managerial skills, all of them "assets" that are in short supply in small or medium sized firms. This explains why when it has come to analyze the phenomenon of foreign direct investment, the great majority of scholars have equated that subject of research with the study of the behavior of large transnational corporations, since only this type of firms are considered to be in a position to carry out those operations.

With these considerations in mind, it was considered necessary in this study to come up with a very clear cut indicator of size which would be based on an accepted and well known criteria. Three main possibilities existed. The first one would be to establish our own working definition on the basis of some statistical observation. For example, taking into account the size distribution of all firms in each country and coming up with a certain classification. The other — related with our object of study — would be to analyze the size distribution of firms that operate abroad in order to proceed to suggest significant categories. Both possibilities had their shortcomings. The former required information on firms — and not only on establishments — which was

not available for all countries. The latter was only partially available for the U.S. and Japan and thus, could not be used for the other countries. A third possibility was to select those definitions used in each country by governmental institutions that in one way or another have to do with SME's. In fact, for all the seven developed countries included in this study some official definitions exist as to what should be considered an SME. Those statements are constructed taking into consideration the pattern of employment as the main criteria, although in some countries also other variables are used to establish the referred definition. Table 1 includes a presentation of these different criteria.

Taking into account those antecedents, and having in mind the need of using in this study a simple working definition, an SME was considered to be a firm that in its home country had up to 500 employees. This criteria is similar to the one most frequently followed by governmental institutions in the seven countries — although the corresponding figure is smaller than the one used in the U.S. and higher than the one employed in Japan — and is easier to use than other measures.

No doubt this chosen definition is extremely restrictive. In fact, since the object of study of this research is the internationalization of firm's productive activities, it could well be appropriate to use a much higher ceiling regarding firm's size. It should be recalled that the "standard" transnational corporation which is the focus of much of the literature on international business frequently employs thousands of persons in its home country alone.

It is also important to indicate, that in order to be included in this survey and be considered an SME, a firm had also to be an independent firm. That is, a firm that as far as could be gauged from the interviews, was not controlled by another firm or economic group, and that was in a position of freely taking the decision of transferring technology abroad.

Table 1

Official criteria used by selected developed countries to define manufacturing SMEs.

Country	Category	Use	Upper Ceilings			
			Employees	Turnover	Assets	
Canada	Small	Statistical	100	--	--	Sources: Statistics Canada. Small Business Act.
	Small	Financing	--	\$2m. Can.	--	
	Medium	Statistical	--	\$20m. Can.	--	
France	Small	Statistical	50	--	--	Foundries & metal industries, mechanical industry, building materials, textiles, paper, cardboard and graphic industries. All other manufacturing industries. Sources: Confederation Generale des Petites et Moyennes Entreprises. French Economic and Social Committee.
	Medium	Statistical	200	.....	.....	
	Medium	Statistical	500	.....	.....	
	Medium	Statistical	--	Ff 50m.	--	
Germany	Small	General	50	Dm 2m.	--	Qualitative criteria: - Do not as a rule borrow in the capital markets. - Run independently by persons working on their own account, who are directly involved in the work, and bear all the risks. Source: Bundestag-drucksache VI/1666.
	Medium	General	500	dm 25 m.	--	
Italy	S.M.E	Financing	500	--	1. 3000M.	Source: Leggi sul Finanziamento.
Japan	S.M.E	General	300	--	Y 100m.	Source: S.M.E. Fundamental Law.
U.K.	Small	Statistical	200	--	--	Qualitative Criteria: - Small share of the market. - Managed by its owners. - Does not form part of a larger enterprise. Source: Small Firms Division, Department of Industry.
	Medium	Statistical	1000	--	--	
U.S.A.	Small	Statistical	500	--	--	Qualitative Criteria: - Independently owned and operated. - Not dominant in its field of operation. - Characteristics of the industry.
		Loans	250-1500	--	--	
		Procurement	500-1500	--	--	
		Investment assistance	--	--	9m. USd	Sources: Small Business Administration. Small Business Act.

## 2. Sample selection

As referred in the Introduction, the field work for this study, was carried out in six developing and seven developed countries. Suppliers of technology, that is SMEs — were interviewed in the latter while the same was done with recipient firms in the former countries. The procedure to identify and select firms to be studied consisted in:

i) The team of researchers under the coordination of CEDREI agreed to circumscribe to a given set of industries the cases of technology transfer to be studied. Specifically, only cases from the chemical and allied products, textiles, paper, and porcelain, metal products, machinery, electric and electronic equipment, measuring equipment, optical equipment and transportation equipment industries were selected.

ii) It was agreed that each country researcher would try as much as possible to elaborate its sample in a way that a variety of cases from different industries, different countries of origin or destination of the technology transfer and different organizational forms to transfer know hows would be included.

iii) Researchers from developing countries obtained from official sources lists of foreign firms which had exported technologies to their countries related to the above mentioned industries. This information was forwarded to developed country researchers. It is important to indicate that the nature of the lists was not equal for all six developing countries. In fact, in the cases of Argentina, Brazil, Korea and Mexico, data was available regarding foreign firms which had carried out investments as well as in relation to foreign firms which had licensed their technology. For Singapore the basic information available had to do only with foreign investments, while for India only data regarding technical collaborations was at hand. This differences have mainly to do with the nature of the institutional setting which regulates the import of technology in these six countries.

iv) Researchers in the seven developed countries went through the referred lists in order to identify the size as well as the "independence" of the firms established in them which had transferred technology to some of the above mentioned developing countries. This task was performed using secondary information contained in industry directory's. The names of the SMEs which were identified in those lists were communicated to CEDREI and to the corresponding developing country researchers.

v) The latter researchers assembled all the information on cases with SME involvement and constructed an "indicative sample" which was in turn communicated to CEDREI. From this Centre suggestions were in turn made as to ways to correct those samples in order to take into account as far as possible the need to balance the industries included, the countries of origin and the organizational form of the ventures. With this guidance, developing country researchers went on to interview recipient firms. Once the agreed number of cases was covered, the relevant data as well as a copy of the questionnaires was sent to CEDREI.

vi) With the information on the cases interviewed in the South, developed country researchers went on to carry out their own interviews. Their target was to try as much as possible to get in touch with the same SME whose technology transfer experience was already looked at from the perspective of its recipient partner (be it a subsidiary, a joint venture, or a licensee). This objective proved to be very difficult to attain. In fact, in contrast with most developing country cases — which were concentrated (with the exception of India) in one or two large metropolitan areas — the SMEs to be interviewed were widely spread over the territory of the developed countries considered, and as a consequence, it was impossible taking into account the resources available to the researchers, to match all interviews made previously in developing countries.

vii) In the end, and after excluding a series of interviews which did not fit the

criteria of this study — that is, suppliers were larger than expected or were subsidiaries of large undertakings, no technology transfer was really made, the operation was not related to manufacturing know hows, etc. — a total of 114 cases were selected. The data on them was derived from 72 interviews carried out in the industrialized countries and 76 performed in the six recipient countries. In 34 cases, the supplier as well as the recipient corresponding to the same technology transfer experience were interviewed.

### 3. Sample description

The empirical evidence in which this study is based consists of 114 cases of technology transfer from 106 SMEs (7 SMEs were protagonists of transfers to more than one of the recipient countries). The following tables present the distribution of cases by countries of origin and recipient countries, industrial sectors, forms of involvement and time period of the operations.

Table 2 indicates that India is the recipient country with the largest number of cases, followed by Argentina, Brazil, Mexico, Singapore and Korea. In terms of the countries of origin of the projects, United States technology suppliers are strongly concentrated in Mexico, and secondly in Brazil; Canada and the U.K., in India; France in Mexico; Italy in Argentina; and Japan in Singapore; while German SMEs are more evenly distributed among the 6 recipient countries, except for Singapore. These combinations reflect to some extent historical patterns of geographical orientation of direct investments and technology transfers from those developed countries to the six selected developing countries.

**Table 2**  
**Case studies of technology transfer, by source and recipient countries.**  
 (Number of cases in percentages)

Recipient countries	Home countries							Total	Absolute figures
	Canada	France	Germany	Italy	Japan	U.K.	U.S.		
Argentina	3%	25%	29%	56%	--	--	11%	18%	20
Brazil	13%	13%	24%	17%	--	6%	28%	16%	18
India	47%	13%	18%	17%	--	63%	--	27%	31
Korea	17%	--	6%	6%	14%	13%	11%	11%	12
Mexico	10%	38%	18%	--	--	--	44%	15%	17
Singapore	10%	13%	6%	6%	86%	19%	6%	14%	16
Total	100%	100%	100%	100%	100%	100%	100%	100%	
Absolute figures	30	8	17	18	7	16	18	114	

It is important to underline that these "semi-industrialized" countries have very different features. From the start (see Table 3) they include the second most populated country in the world — India — together with a small "city-state" — Singapore — which has only 2.4 million inhabitants. In addition, their total GNP, as well as per capita income also differs, and the same can be said with respect to their economic growth performance. More so, while some are relatively open economies — Singapore again — others are (India) or have been (the three Latin Americans) in the period in which the studied experiences were implemented, relatively closed economies. In the same vein, the stability or instability of the economic climate (proxied in Table 3 by the evolution of consumer prices) has also varied strongly among them. The referred variable, coupled with the institutional setting vis á vis inflows of foreign direct investment and/or imports of arms-length technology, is very significant at the time of understanding the steps taken by SMEs and recipient firms with regard to the transfer/acquisition of technology.

**Table 3**  
**Some basic indicators of recipient developing countries.**

	Argentina	Brazil	India	Korea	Mexico	Singapore
Population (millions) 1980	28	118	675	38	69	2.4
GNP (billions USD) 1965	16	19	60	3	22	1
GNP (billions USD) 1980	72	255	153	57	138	11
GNP (billions USD) 1988	79	323	238	171	177	24
GNP average annual growth 1965-80	3.5	8.8	3.6	9.6	6.5	10.1
GNP average annual growth 1980-88	-0.2	2.9	5.2	9.9	0.5	5.7
GNP per capita average annual growth 1965-88	0	3.6	1.8	6.8	2.3	7.2
GNP per capita 1980 (USD)	2590	2160	230	1500	1980	4400
GNP per capita 1988 (USD)	2520	2160	340	3600	1760	9070
Average annual rate of inflation 1965-80	78.2	31.5	7.5	18.7	13.0	4.9
Average annual rate of inflation 1980-88	290.5	188.7	7.4	5.0	73.8	1.2
Adult literacy rate 1985	95%	78%	43%	..	90%	86%
Percent of manufacturing in the GDP 1965	33	26	16	18	20	15
Percent of manufacturing in the GDP 1988	31	29	19	32	26	30
Percent of exports in the GDP 1965	8	8	4	9	8	123
Percent of exports in the GDP 1988	10	10	7	41	16	..

Source: The World Bank, World Development Report 1990.

Table 4 reflects the industry profile of the sample. Non-electrical machinery, chemicals, and electro-electronic equipment, in that order, are the three main sectors in terms of number of technology transfer operations. The machinery sector is overwhelming in Brazil (71% of the cases) and is highly represented in India; chemicals are slightly above the average in Mexico, Singapore, Argentina and Brazil; electro-electronic projects stand out in the Singapore sample; metal products have a significant share in Mexico; transport equipment cases predominate in Korea, and scientific and measurement equipment have some significance in Singapore.

**Table 4**  
**Industry distribution of technology transfer cases by recipient countries.**  
(Nr. of cases, in percentages)

Recipient countries	Chemicals	Metal products	Non electric machinery	Electric/ electronic	Scientific/ measur. equipment	Transport. equipment	Other	Total	Abs. fig.
Argentina	20%	10%	35%	25%	5%	5%	--	100%	20
Brazil	17%	6%	72%	--	6%	--	--	100%	18
India	13%	6%	42%	13%	10%	10%	6%	100%	31
Korea	17%	--	25%	25%	--	25%	8%	100%	12
Mexico	35%	24%	24%	12%	6%	--	--	100%	17
Singapore	19%	13%	25%	25%	19%	--	--	100%	16
Total	19%	10%	39%	16%	8%	6%	3%	100%	
Abs. fig.	22	11	44	18	9	7	3	114	

Finally, it is worth mentioning, that the majority of the studied cases were implemented from 1976-1985 although important differences existed at this respect among recipient countries. While Indian and Korean ventures were carried out mainly from 1980 onwards, most of Brazilian initiatives corresponded to the decade of the seventies. Half of the cases with Argentina as host country corresponded to 1976-1980. For the rest, cases are more widely split through a larger period of time (see Table 5).

**Table 5**  
**Time periods of the technology transfer operations by recipient countries.**  
(Nr. of cases, in percentages)

Recipient countries	Till 1970	1971-75	1976-80	1981-85	After 1985	Total	Abs. fig.
Argentina	10%	5%	50%	20%	15%	100%	20
Brazil	17%	44%	17%	17%	6%	100%	18
India	3%	6%	3%	61%	26%	100%	31
Korea	--	8%	8%	67%	17%	100%	12
Mexico	24%	35%	12%	29%	--	100%	17
Singapore	6%	25%	38%	25%	6%	100%	16
Total	10%	19%	20%	38%	13%	100%	
Abs. fig.	11	22	23	43	15	114	

## **CHAPTER II**

### **MAIN FEATURES OF STUDIED SMEs**

This Chapter presents on the one hand some basic features of sample SMEs such as their size, industry, relative position in their domestic markets and technological behavior. On the other, the export performance of those firms and some basic traits of their international production expansion are put forward.

#### **A. BASIC TRAITS**

##### **1. Size, location and industry**

As set forth in the previous Chapter, the criteria adopted to classify sample SMEs was the number of employees. According to it for the whole 106 cases studied, the average size was of 228 employees per firm. In most cases (66%), however, companies with no more than 300 employees were involved, while the remaining 34% included companies with up to 500 employees (see Table 6). With respect to annual sales, another indicator of size, the average for the sample was 34 million dollars. Following this parameter, minor firms prevail too. As a matter of fact, only 27% of the sample recorded sales of over 50 million dollars a year, while out of the remaining 73%, half recorded sales revenues of less than 10 million dollars a year (see Table 7). In addition, its worth indicating that 86% of the firms were family owned.

**Table 6**  
**Sample SMEs classified by number of employees and home country.**

Home country	Number of employees							
	5-100		101-300		301-500		Total	
	Abs.fig.	%	Abs.fig.	%	Abs.fig.	%	Abs.fig.	%
Canada	14	52%	9	33%	4	15%	27	100%
France	1	13%	3	38%	4	50%	8	100%
Germany	3	23%	5	38%	5	38%	13	100%
Italy	5	28%	8	44%	5	28%	18	100%
Japan	--	--	2	29%	5	71%	7	100%
U.K.	5	33%	4	27%	6	40%	15	100%
U.S.A.	2	11%	9	50%	7	39%	18	100%
Total	30	28%	40	38%	36	34%	106	100%

**Table 7**  
**Sample SMEs classified by annual sales and home country.**

Home country	Annual sales (mill. US\$)												Total	
	<1		1-5		5-10		10-25		25-50		>=50			
	Abs.fig.	%	Abs.fig.	%	Abs.fig.	%	Abs.fig.	%	Abs.fig.	%	Abs.fig.	%	Abs.fig.	%
Canada	5	19%	5	19%	--	--	6	23%	6	23%	4	15%	26	100%
France	--	--	--	--	1	17%	2	33%	2	33%	1	17%	6	100%
Germany	--	--	1	10%	3	30%	2	20%	2	20%	2	20%	10	100%
Italy	--	--	--	--	1	11%	5	56%	--	--	3	33%	9	100%
Japan	--	--	--	--	1	20%	1	20%	--	--	3	60%	5	100%
U.K.	--	--	1	8%	2	17%	--	--	5	42%	4	33%	12	100%
U.S.A.	--	--	1	7%	2	14%	5	36%	1	7%	5	36%	14	100%
Total	5	6%	8	10%	10	12%	21	26%	16	20%	22	27%	82	100%

The distribution by size varies significantly according to the industrial sectors concerned. As can be seen in Table 8, while most SMEs established in the scientific, measuring and optical equipment had up to 100 employees, the majority of those corresponding to the chemical industry had over 300 employees. The intermediate size category (that is, that between 101-300 employees) appear as particularly important for the metal products branch as well as for SMEs established in the non-electrical machinery industry, the larger group in the sample.

**Table 8**  
**Sample SMEs classified by size and industry**  
 (Number of SMEs, in percentages)

Industries	Nr. of employees			Total	Absolute figures
	5-100	101-300	301-500		
Chemicals and allied products	26%	21%	53%	100%	19
Metal products	9%	64%	27%	100%	11
Machinery, except electrical	22%	49%	29%	100%	41
Electric & electronic equipment	41%	18%	41%	100%	17
Scientific, measuring and optical equipment	56%	33%	11%	100%	9
Transportation equipment	33%	33%	33%	100%	6
Other manufacturing *	33%	33%	33%	100%	3
Total	32%	36%	33%	100%	106
Absolute figures	30	40	36		

\* Note: Includes textiles, paper, and ceramics.

Firms that belong to non electrical machinery, the chemical industry, and the electric and electronic equipment sector, are specialized firms in terms of product lines and highly focused on specific markets. As a matter of fact 39% of sample SMEs manufacture one product line and 63% are dedicated to one market, almost always represented by another industry. Only about 10% of the SMEs are significantly diversified, in the sense that they deal with products of different industries. The sectors with a larger share of diversified firms are electrical-electronic, scientific and precision instruments, and chemical products. Firms in the transport equipment industry are the least diversified in terms of product lines. Chemicals and electrical firms are those that exploit more markets (See Table 9)<sup>1</sup>.

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<sup>1</sup>For a list of main product lines of sample SMEs see the Annex.

**Table 9**  
**Product and market diversification, by industries**  
 (Number of SMEs, in percentages)

Industries	Nr. of product lines				Absolute figures	Nr. of markets			Absolute figures
	1	>1	Diff.tech.	Total		1	>1	Total	
Chemicals and allied products	33%	67%	--	100%	18	44%	56%	100%	18
Metal products	36%	55%	9%	100%	11	90%	10%	100%	10
Machinery, except electrical	42%	47%	11%	100%	38	65%	35%	100%	37
Electric/Electronic equipment	31%	56%	13%	100%	16	63%	37%	100%	16
Scientific, measuring and optical equipment	33%	44%	22%	100%	9	67%	33%	100%	6
Transportation equipment	67%	33%	--	100%	6	50%	50%	100%	6
Other manufacturing*	--	100%	--	100%	1	100%	--	100%	2
Total	38%	53%	9%	100%	99	63%	37%	100%	95
Abs. fig.	38	52	9			60	35		

\* Note: Includes textiles, paper, and ceramics.

## 2. Relative position and market structure

To establish the relative position of sample SMEs and the structure of the industries in which they operate, two basic sources of information were used. First, this exercise was based on the data from a U.S. survey carried out in 1982 by the Bureau of The Census which presents information on concentration ratios for that country at the firm level (U.S. Bureau of the Census, 1982). Although too aggregated (industries are defined at 4 digits), this information is useful for exploring the different general conditions of the various industrial structures in which SMEs operate<sup>2</sup>. Secondly, the firm-level information collected in the interviews about the actual market structures in which the SMEs were operating in their respective home countries was examined.

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<sup>2</sup>Given the difficulties of obtaining the same information for the 7 countries of origin, only U.S. data was used as a proxy for the whole population. The utilization of this source for interpreting the situation of industries of other countries is acceptable, since as a whole the levels of concentration of the different industries of developed countries are roughly similar (Schepherd 1985).

- a) Levels of industrial concentration and the position occupied by SMEs according to the U.S. industrial structure.

In the first place, and for the industries in which all the sample SMEs were established (that is, including SMEs of all the seven countries of origin), an effort was made to examine the structure they present in the U.S., the country with the largest industrial sector. The purpose of this exercise was to shed light on the degree of concentration of each market and the place occupied by SMEs in them.

In the referred U.S. survey, the data presented corresponds to the percentage of sales in each industry accounted for by groups of firms ordered from the largest to the smallest. More precisely, the information corresponds to the share in total sales of each industry controlled by the 4 largest firms, the 8 largest, the 20 largest, the 50 largest, and the rest of firms established in it. For each of those five groupings the sales average was calculated. Only those strata in which annual sales of all firms included were below u\$s 100 million were considered as part of the SME category (for more details see the Appendix to this Chapter).

For the 44 industries where the sample firms operate, Table 10 provides some indicators of their respective market structure in the U.S. An important feature of many of these markets is that they show remarkable concentration indexes. As a matter of fact, according to the classification used in the table it is evident that in the U.S., the 32.5% of the markets where sample SMEs operate is highly concentrated; other 32.5% has a moderate concentration level and only the remaining 35% has low concentration levels. Not surprisingly, moderate or low concentration levels frequently coincide with the existence of many companies in the same market (with only one exception in this latter group<sup>3</sup>), and in 70% of the cases, high concentration ratios account for markets

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<sup>3</sup>Plastic materials and synthetic resins (SIC 2821).

where less than 300 firms operate. Notwithstanding this fact, for a subset of industries (30% of all branches considered) high concentration indexes were found to coexist with a population of over 300 firms.

Small and medium-sized firms account for at least 60% of the total sales in almost all the markets recording low concentration levels<sup>4</sup>. This empirical verification could be expected as long as they refer to industries in which productive processes, in general, are not based on the exploitation of economies of scale important enough to erect barriers to the entry of relative smaller size firms. In addition, and given the way the category of highly concentrated industries has been defined, it is not surprising to verify the existence of ten cases (over 13) in which the share in them of small and medium-sized firms was small (less than 30% of total sales).

But in some cases, the existence of a direct inverse relationship between the concentration level and the relative share of small and medium-sized firms cannot be asserted. Taking into account the group of markets with a relatively high concentration ratio, that is to say where the 4 largest firms account for between 25% and 40%, or the 8 largest between 40% and 70%, it can be observed that only in 3 branches (out of 13) the share of small and medium-sized firms is marginal; while in the majority of the remaining sectors those firms are able to place themselves in a leading position, — between the 4 largest — and hold a dominant share (namely they account for over 60% of the total sales of the sector).

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<sup>4</sup>There are three exceptions pertaining to radio and television transmitting, signaling, and detection equipment and apparatus (SIC 3662), plastic materials, synthetic resins and nonvulcanizable elastomers (SIC 2821) and pumps and pumping equipment (SIC 3561).

**Table 10**  
**The relative position of SMEs according to the U.S. industrial structure.**

SIC	Total sales (mill.u\$s)	Nr of firms	% of sales accounted by largest firms				Industry structure			Sales SMEs			Upper limit SME's class	SME's share in total sales
			4	8	20	50	Concentration	Population	Total sales value	Total value	%	Average /firm		
3079	\$37,013	10152	7	10	17	26	low	many firms	very large	\$27,390	74	\$2.7	\$57	Dominant share
3559	\$5,348	1754	9	15	27	44	low	many firms	large	\$4,546	85	\$2.6	\$80	Dominant share
3442	\$4,685	1564	11	17	30	47	low	many firms	large	\$3,889	83	\$2.5	\$70	Dominant share
3569	\$4,554	1390	9	15	27	43	low	many firms	large	\$3,871	85	\$2.8	\$68	Dominant share
3499	\$4,406	2910	13	18	28	39	low	many firms	large	\$3,613	82	\$1.2	\$55	Dominant share
3441	\$8,853	2588	10	15	24	36	low	many firms	large	\$6,728	76	\$2.6	\$66	Dominant share
3452	\$3,661	780	13	23	38	58	low	many firms	large	\$2,819	77	\$3.7	\$92	Dominant share
3549	\$1,471	421	17	26	44	69	low	many firms	medium	\$1,471	100	\$3.5	\$79	Dominant share
3552	\$1,059	511	22	32	48	68	low	many firms	medium	\$1,059	100	\$2.1	\$71	Dominant share
3551	\$2,320	703	15	23	38	57	low	many firms	medium	\$1,972	85	\$2.8	\$87	Dominant share
2252	\$1,443	376	20	29	48	70	low	many firms	medium	\$1,154	80	\$3.1	\$72	Dominant share
2891	\$2,857	518	21	33	50	70	low	many firms	medium	\$1,914	67	\$3.8	\$86	Dominant share
3829	\$2,223	693	24	33	48	67	low	many firms	medium	\$1,489	67	\$2.2	\$50	Dominant share
3567	\$1,102	321	24	36	54	74	low	many firms	medium	\$838	76	\$2.6	\$66	Dominant share
3643	\$2,510	357	28	39	56	77	moderate	many firms	medium	\$1,531	61	\$4.4	\$69	Dominant share
3699	\$1,276	714	27	34	47	63	moderate	many firms	medium	\$931	73	\$1.3	\$86	Dominant share
3629	\$1,111	309	26	42	65	85	moderate	many firms	medium	\$822	74	\$2.7	\$72	Dominant share
3648	\$1,028	222	31	44	63	82	moderate	few firms	medium	\$709	69	\$3.3	\$80	Dominant share
3824	\$728	133	38	59	81	95	moderate	few firms	small	\$451	62	\$3.5	\$69	Dominant share
3021	\$706	53	39	61	94	100	moderate	few firms	small	\$431	61	\$8.8	\$69	Dominant share
3493	\$413	123	43	59	81	94	high	few firms	small	\$413	100	\$3.4	\$53	Dominant share
2899	\$6,344	1245	22	32	46	63	low	many firms	large	\$3,426	54	\$2.8	\$74	Important
3494	\$9,039	944	13	21	35	55	low	many firms	large	\$4,068	45	\$4.5	\$60	Important
3679	\$14,401	3575	31	37	47	57	moderate	many firms	very large	\$6,192	43	\$1.8	\$48	Important
3811	\$3,046	738	31	43	59	75	moderate	many firms	large	\$1,736	57	\$2.4	\$91	Important
3832	\$3,757	574	29	40	59	77	moderate	many firms	large	\$1,540	41	\$2.8	\$59	Important
3532	\$2,109	316	36	49	69	87	moderate	many firms	medium	\$1,076	51	\$3.5	\$69	Important
3264	\$528	79	47	63	83	98	high	few firms	small	\$280	53	\$3.7	\$62	Important
3261	\$474	41	63	85	99	100	high	few firms	small	\$175	37	\$4.7	\$75	Important
3662	\$33,031	2083	22	35	57	73	low	many firms	very large	\$8,918	27	\$4.4	\$90	Marginal
2821	\$15,769	263	22	38	64	89	low	few firms	very large	\$1,735	11	\$8.1	\$70	Marginal
3561	\$6,198	516	19	30	51	77	low	many firms	large	\$1,426	23	\$3.1	\$54	Marginal
3585	\$12,390	730	34	46	65	80	moderate	many firms	very large	\$2,478	20	\$3.6	\$62	Marginal
2834	\$18,997	584	26	42	69	90	moderate	many firms	very large	\$1,900	10	\$3.6	\$68	Marginal
2831	\$2,300	287	31	49	74	92	moderate	few firms	medium	\$598	26	\$2.2	\$48	Marginal
3714	\$36,293	2000	61	69	77	84	high	many firms	very large	\$5,807	16	\$3.0	\$85	Marginal
3573	\$36,767	1520	43	55	71	82	high	many firms	very large	\$6,618	18	\$4.5	\$70	Marginal
3531	\$11,657	817	42	52	69	81	high	many firms	very large	\$2,215	19	\$2.9	\$47	Marginal
3411	\$11,132	168	50	68	89	98	high	few firms	very large	\$223	2	\$1.9	\$33	Marginal
3613	\$5,192	514	45	57	72	84	high	many firms	large	\$1,454	28	\$2.9	\$65	Marginal
2211	\$3,972	209	41	65	85	97	high	few firms	large	\$596	15	\$3.2	\$66	Marginal
3743	\$3,456	158	58	71	88	97	high	few firms	large	\$415	12	\$3.0	\$49	Marginal
3563	\$3,270	239	41	57	79	92	high	few firms	large	\$687	21	\$3.1	\$60	Marginal
3612	\$2,916	240	52	70	84	94	high	few firms	medium	\$467	16	\$2.1	\$34	Marginal
3631	\$2,414	71	52	73	93	99	high	few firms	medium	\$169	7	\$3.3	\$40	Marginal

Source: U.S. Bureau of the Census (1986): 1982 Census of Manufactures, Concentration Ratios in Manufacturing, Table 5.

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Note to Table 10 (column headings)

- 1) Industry structure:
    - i) Concentration levels:
      - a) High: the 4 largest account for more than 40%, or the 8 largest for more than 70% of sales.
      - b) Moderate: the 4 largest account for between 25% and 40%, or the 8 largest between 40% and 70% of sales.
      - c) Low: the 4 largest account for less than 25%, or the 8 largest for less than 40% of sales.
    - ii) Industry's population:
      - a) Many firms: industries with more than 300 firms.
      - b) Few firms: industries with up to 300 firms.
    - iii) Total sales value (size of industries).
      - a) Very large: more than u\$s 10 billion.
      - b) Large: more than u\$s 3 and up to 10 billion.
      - c) Medium: more than u\$s 1 and up to 3 billion.
      - d) Small: up to u\$s 1 billion.
  - 2) SMEs sales value: size of total sales by SMEs in respective industries.
  - 3) Upper limit SMEs class: Average sales of the sales category immediately above the SMEs class (no SME reaches such sales value).
  - 4) SMEs share in total sales: Share of each industry accumulated by categories of firms with annual average sales of less than u\$s 100 million:
    - i) Dominant share: 60%
    - ii) Important: between 30% and 60%
    - iii) Marginal: less than 30%
- 

However, the most remarkable cases of relative share of small and medium-sized firms are those of the industries of porcelain electric supplies (SIC 3264) and earthenware bathroom accessories (SIC 3261) in which they occupy a place among the 4 largest. Finally, let's point out the existence of the springs industry (SIC 3493) where only small and medium firms operate.

Summing up, the analysis of these data shows that 65% of the industries where sample small and medium-sized firms operate have remarkable high concentration levels even having pursue the exercise using the data of the larger industrial economy and sticking to a four digit classification. As it has already been stressed, the interesting point is that the existence of small and medium-sized firms in these situations does not always imply that the production is concentrated in the hands of a few big companies. On the contrary, even when faced with high concentration levels, situations were detected of industries where only small and medium-sized firms operate or those in

which they are placed in leading positions in competition with big enterprises. On the other hand, the fact that some companies of smaller absolute size occupy quite a remarkable share of the market suggests that they have the capacity to generate competitive advantages and to appropriate them to build barriers to the entry of competitors.

b) Concentration and oligopoly: the view of sample SMEs.

The information stemming from the interviews to sample SMEs confirmed the impression derived using the referred U.S. survey about the significance these firms have in the industries where they are located. In particular, the replies of those interviewed resulted in two quite interesting features referred to the SMEs share in the respective domestic markets<sup>5</sup>.

First, as regards their main product lines, 48% of the firms alleged to have a share higher than 40% of their respective domestic market, 26% considered they controlled between 20% and 40%, and only 26% alleged to hold a proportion lower than a fifth of the total market. Only to one sector (that of electric and electronic equipment) do belong most of the sample SMEs that state to hold less than 20% of the respective market. In all the other cases, — except in chemicals and allied products and in metal products — more than half can assert they dominated over 40% of the market for its major product. That is, a very important proportion of SMEs hold oligopolistic positions in their markets, in the sense that unilateral decisions taken by them would in all probability affect the conditions of operation of their competitors. In the second place, it should be stressed that over half of the firms that furnished information

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<sup>5</sup>It should be stated that only 66 of all the firms interviewed provided information about the share they occupied in their respective industries.

regarding the current conditions in their domestic market stated that they were confronting few competitors. Not surprisingly this judgement was advanced by 88% of the companies alleging to have oligopolistic positions (namely, to control over 40% of the market).

In conclusion, far from operating in low concentrated markets characterized by the proliferation of firms, it seems that the sample SMEs have been able to conquer quite important positions in highly concentrated markets from a double point of view: they account for a quite remarkable share of total production and confront a reduced number of competitors. On the other hand, the market power of these companies is strengthened by the fact that frequently (63% of the cases, in their own evaluation), they operate in non concentrated markets on the demand side.

### 3. Technological behavior

The relation between the expenses incurred in R&D over total sales indicates — even though imperfectly (refer, for example, to Dossi and Momigliano 1983) — the "technological intensity" of firms. With that aim, Kelly (1977) estimated for the U.S. manufacturing industry the mean value of the referred ratio for each sector. The conclusion of this analysis was that on average, U.S. firms spent the equivalent of 2.26% of sales in performing activities in connection with R&D.

Placing the data of the industries of studied SMEs in comparison with Kelly's results it comes out that nearly 74% of the cases were established in "non technology intensive" industrial sectors — namely, where in average, firms allotted to R&D less than 2,26% of their sales and only the remaining 26% belonged to "technology intensive" industries. Non-technology intensive industries highly represented in the sample are metalworking and industrial machinery, metal products and some chemicals.

On the other hand, among the industries considered technologically intensive it is possible to place those devoted to electronic equipment and components, scientific and precision instruments and a number of chemical specialties.

**Table 11**  
**R&D intensity of sample SMEs compared to sector mean, by industrial sectors.**  
 (Number of SMEs, in percentages)

Industries	R&D compared to sector mean			Total	Absolute figures
	Less	1-3 times	>3 times		
Chemicals and allied products	20%	30%	50%	100%	10
Metal products	33%	67%	--	100%	3
Machinery, except electrical	19%	44%	38%	100%	16
Electric/electronic equipment	56%	11%	33%	100%	9
Scientific, measuring and optical equipment	50%	50%	--	100%	4
Transportation equipment	50%	50%	--	100%	2
Total	33%	34%	33%	100%	44
Absolute figures	14	16	14		

For a group of 44 sample SMEs information on their own expenses on R&D was obtained: When placed in comparison with the data for the average firm in their same industry, it comes out conclusively that the majority of studied SMEs surpassed their competitors at this respect. Albeit the limitations of such an exercise, the fact, as table 11 shows, that 67% of those SMEs for which information could be gathered devoted at least one time more resources to R&D than their counterparts, suggests that these firms can be labelled as technology intensive undertakings (for an illustration see Box A).

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**Box A**  
**A High-Tech Export-Oriented Canadian SME**

This is a specialized telecommunications producer founded in the early eighties out of a foreign subsidiary purchased by its Canadian executives. It is located in a Montreal suburb. Although it has only 250 employees, it is now the world largest supplier of point-to-point microwave digital radio systems. A public company, it has grown at a very rapid pace. Producing in batches for an expected demand, exports account for more than 80% of the company's sales.

The company bought its very basic technology from the mother foreign company and, through intense research and development (16% of sales go to R&D) it came to the forefront of this specialized technology.

Its product gives radio service to remote and scarcely populated areas, connecting the isolated users with the conventional telephone network. This technology has proved useful in many developing countries; in three of them Company XX has signed technology agreements with local firms in order to produce some of its equipment.

Niosi, J.,  
CEDREI-IDRC, Vol.I, 1990.

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**B. INTERNATIONAL INVOLVEMENT**

**1. Export performance**

For sample SMEs exports constitute a large share of their overall sales. As a matter of fact, 52% of the companies for which data could be gathered, export more than 50% of their total production while only 10% export less than 10%<sup>6</sup>. As Table 12 shows, firms in the machinery and electric/electronic equipment industries appear as those with a higher export propensity.

What is interesting is that the openness towards foreign markets is independent of the size of the firms and of the relative position achieved by them in their respective domestic markets. Most firms with less than 100 employees, as well as those with over 300, export more than half of their production. Equally devoted to foreign markets are

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<sup>6</sup>Data are available on exports to sales ratio for 62 sample SMEs.

nearly 60% of the intermediate size companies. Also, the majority of those SMEs maintaining dominant positions (that is accounting for more than 40% of the sales of the industry in their country of origin) as well as those with a relatively smaller share (less than 20% of the respective domestic market), export more than half of their production. On the other hand, and not surprisingly, the proportion of export-intensive SMEs is higher among the most R&D intensive<sup>7</sup> ones than among the rest<sup>8</sup>.

**Table 12**  
**Export propensity by industries**  
(Nr. of SMEs, in percentages)

Industries	Exports/sales ratio				Total	Abs. fig.
	<10%	10-25%	25-50%	>=50%		
Chemicals and allied products	--	50%	--	50%	100%	12
Metal products	--	38%	38%	25%	100%	8
Machinery, except electrical	13%	4%	17%	65%	100%	23
Electric/electronic equipment	11%	11%	--	78%	100%	9
Scientific, measuring and optical equipment	--	40%	40%	20%	100%	5
Transportation equipment	50%	25%	25%	--	100%	4
Other manufacturing *	--	--	--	100%	100%	1
Total	10%	22%	16%	52%	100%	62
Absolute figures	6	14	10	32		

\* Note: this sector includes textiles, paper, and ceramics.

Regarding the destination of exports, a third direct them exclusively to developed countries; 46% sell their products both in developing and developed countries and only 21% export part of their production exclusively to developing countries. It is appropriate to refer in this regard that those firms exporting mainly to other industrialized countries were found to spend a relatively larger amount in R&D efforts.

<sup>7</sup>As regards the relationship between competitiveness in the international market and innovative activity refer to, for example, Dossi, Pavitt, Soete (1990).

<sup>8</sup>According to data obtained for 52 firms, 85% of those allotting the equivalent of more than 5% of their sales to R&D export more than half of their production.

## 2. Overseas production operations

Sample SMEs were asked about their overall experience in international production ventures at the time of their participation in the case study which was singled out in the current research, as well as at the moment they were interviewed

The first important finding was that for 65% of sample SMEs, the studied venture was their first international production involvement. Furthermore, of those that had gained a previous experience, 58% had operated abroad only in developing countries. In other words, and rather striking at the light of the received literature, the majority of studied SMEs took their first steps in relation with the overseas transfer of productive resources in environments which were quite different from the ones they happened to be most familiar with.

In order to deepen the understanding of the main factors which were behind SMEs international participation, firms were asked to indicate the one considered the most significant with respect to the case study singled out in this inquiry. The results are presented in table 13. As it can be observed, a first meaningful distinction has to do with the fact that for half of the sample SMEs the main determinant was the existence of an outside proposal — that is to say, an invitation by an established firm (or occasionally an individual) in a given developing country, — while for the other half the decision to move abroad stemmed from the supplier itself. In these cases the recipient country's growth perspective were given particular importance in all countries with the exception of Argentina. This finding is not surprising given the distinctive weak economic performance of this country during the last two decades, in comparison with the much more dynamic situation of the other five economies. Import barriers played an important role in ventures in Brazil and, to a lesser extent, in Mexico and India, while the use of the recipient country as an export platform was put forward as

an argument in a few cases in Singapore and Mexico. Finally, government incentives were quoted as the key motivation only in two cases<sup>9</sup>.

**Table 13**  
**Factors leading to foreign production ventures.**  
(Nr. of cases, in percentages)

Main factors	Argentina	Brazil	India	Korea	Mexico	Singapore	Total	Abs.fig.
Outside proposals	95%	33%	59%	56%	24%	13%	49%	52
Other referred factors								
Growth prospects	5%	28%	22%	22%	41%	53%	27%	29
Import restrictions	--	28%	15%	--	18%	--	11%	12
Re-exporting	--	--	4%	--	12%	20%	6%	6
Government inducements	--	--	--	11%	--	13%	3%	3
Nationals of same origin	--	6%	--	--	--	--	1%	1
Other	--	6%	--	11%	6%	--	3%	3
Total	100%	100%	100%	100%	100%	100%	100%	106
Abs. fig.	20	18	27	9	17	15		

The above referred distinction between SMEs that were led to operate abroad through the role exercised at this respect by firms in recipient countries and "autonomous" SMEs emerges as very significant and is one of the most useful analytical approaches put forward in this report. In fact, and contrary to the standard theory of international production, SMEs' foreign involvement cannot be explained only on the assumption that these firms have an a priori strategy as to their expansion to overseas markets. Furthermore, and as it will be shown in the following Chapter, a large number of them appear to have participated in such ventures — at least in their first involvements — mainly as an opportunity to derive additional income of the licensing of technical resources.

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<sup>9</sup>It is interesting to notice that the presence in the recipient country of nationals -individuals or firms- of the same origin was mentioned as the key motivation by some German SMEs with operations in Latin America. The presence of enterprises of the same nationality was also detected as second or complementary motivation in three other cases.

This last situation is associated usually with SMEs that have a large export experience and that are not attracted by the perspective of producing their goods in foreign unknown locations. An illustration of this pattern has been depicted very clearly by Falzoni and Viesti (see upper part of Box B). Italian SMEs appear to get involved in projects overseas on a one-by-one approach, according to which production ventures abroad are not strongly interlinked among them and with the parent firm. More so, for some of these firms, their international projection is clearly a "second best" option in relation to which they prefer to maintain a relatively low commitment.

The findings of this research demonstrate also that for another group of SMEs their foreign operations constitute part of their growth strategy aimed at implementing a global network (see an illustration in the lower part of Box B). Typically this occurs among firms with a large proportion of sales devoted to R&D efforts and that have opted for deepening their specialization. Rather at odds with the standard theory, these firms are not necessarily those with a relatively larger size. In fact, the evidence from the study has shown that in various cases of very small undertakings, the decision to move overseas has been taken very early in their growth path as a way of maintaining their competitive edge in a very specific product line.

It is also interesting to refer that around 72% of SMEs declared that they had not explored alternative locations before transferring the know hows to the six selected developing countries. This answer was strongly determined by the business experience of SMEs in overseas markets. Those SMEs that had exported to the developing country to which a technology transfer operation was carried out afterwards, usually declared that they had not studied alternative locations. Those that had not exported to those markets did consider other alternatives.

On the other hand, those SMEs which aimed at opening a production facility abroad which would play a role in their strategic planning, did engage in a selection

process. This was typically the case for those investments carried out in Singapore. Not surprisingly, given the relatively large proportion of Japanese SMEs with operations in the former, these suppliers were among those which analyzed more frequently other locations. In contrast, most Italian SMEs declared they have not examined other alternative recipient countries, since their main interest was to perform a specific deal to respond to a demand from a host country firm.

It is appropriate in this context to point out to what extent sample SMEs did engage in the carrying out of market feasibility studies before they decided to transfer resources to developing countries. As a whole 67% declared that they had conducted those efforts. Not surprisingly, this outcome was particularly frequent when the SME established an equity controlled venture (80% of the cases) than when it participated as a licensor (56%). It should be underlined also, that the propensity to undertake those studies was higher in those SMEs run by professional managers and with higher R&D coefficients. In contrast, the majority of those SMEs that responded to outside proposals did not perform those analysis. These firms rested on their recipient counterparts to provide them with the relevant information to reduce the risks associated with the project.

Another related issue has to do with the efforts undergone by SMEs to search for alternative partners or licensees. The survey results indicate that most of the cases (70%) in which a local firm ended participating in the venture, SMEs did not look for alternative firms. These results are explained by the fact that some SMEs had already previous links with a given developing country firm. In addition, the fact that a given firm from a host country decided to take the initiative to approach the SME was usually a determinant factor as to the future of the relationship between them.

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## Box B

### The Multi-Domestic International Strategy

In all cases, Italian SMEs have a multi-domestic international strategy instead of a global one. That is, they face each foreign market in a singular way, without any particular relationship with their behavior and operations in other markets. All foreign operations are in connection with the home country alone; their development and success have little if no relationship with that of other activities abroad.

This is clearly interlinked with the foreign market orientation of the deals: the foreign production should be all addressed to the local market. No flow of

components, parts, semifinished products going from any foreign location to others or to the parent company. This reduces the need for a closer control both on the quality and on the amount of the foreign location production, with possibly no conflict of interest among different foreign ventures if they effectively work for their own local or neighboring markets.

Falzoni, A. and Viesti G.,  
CEDREI-IDRC, Vol.I, 1990.

### The Global Network International Strategy

While large firms clearly learn and benefit from their subsidiaries abroad, we found some evidence that small firms might have some advantages in this area. They seem to be able to exploit their global networks effectively, partly because they lack an extensive bureaucracy that might lengthen their communication and response times.

The processing of one of Firm XX orders is a case in point. The company's sales representative in France received an order from a local customer and relayed it immediately to the manufacturing subsidiary in the U.K. The latter lacked the capability to make the parts, but accepted the order anyway, well aware that the necessary capability existed elsewhere in the organization.

Details of the customer's needs were then transmitted by facsimile to the company's design department in the U.S. Using computer-aided design methods, the U.S. lab prepared production specifications that were transmitted by phone to the company's manufacturing plant in El Paso, Texas. This plant then coordinated with its "twin" unit in Juarez, Mexico to manufacture the parts. From Juarez the finished parts were shipped to El Paso, and from there to the French customer's client in Venezuela. The whole process, from initial order to delivery took only 11 days !

Kohn, T.,  
CEDREI-IDRC, Vol.I, 1990.

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## C. SYNTHESIS

Sample firms are a special type of SMEs, since far from operating in markets with low levels of concentration they have been capable of conquering quite important positions in very concentrated markets. The fact that, in spite of their smaller absolute size, these firms maintain leading positions has much to do with the technological

strategy adopted by them, and particularly with the relatively high proportion of their sales income devoted to research and development.

Most sample firms have a quite high propensity to export. Their respective competitive strategies seem to be structured around the possibility of selling their production in foreign markets, mainly to developed countries. Since they are technology intensive companies, a major part of their technological activity has been conceived bearing in mind the objective of increasing their foreign trade competitiveness.

For most sample SMEs their foreign project in a developing country was their first international production experience. In half the cases studied, they were "pulled" by an outside proposal put to them by a host country firm. The other half was inclined to operate abroad by a combination of internal features — such as a high R&D commitment, — which led them to expand their sales income internationally, and their willingness to benefit from certain attractive features of a given foreign location.

## APPENDIX: ESTIMATES OF SMEs' SALES IN EACH INDUSTRY

As referred in the text, the U.S. survey classifies the data in percentages of sales of each industry accounted for by 5 cumulative groups that include the share accounted for firms ordered from the largest to the smallest. That is, the first 4, the first 8, the first 20, the first 50, and the whole industry. This classification has been designed to show the relative importance of the largest firms. Therefore the significance of the smaller firms in each industry had to be estimated. This task was carried out by:

- 1) Decomposing the cumulative groups in non-cumulative groups (i.e. make a partition in the whole population of firms in each industry) formed by firms grouped according to their positions in total sales:

### Original Cumulative Grouping

C1: 4 largest firms

C2: 8 largest firms

C3: 20 largest firms

C4: 50 largest firms

C5: The whole industry

### Non-Cumulative Grouping

G1: 4 largest firms

G2: 4 followers

G3: 12 followers

G4: 30 followers

G5: Tail of the distribution (the whole industry less the 50 largest)

Where...

$$C1 = G1$$

$$C2 = G1 + G2$$

$$C3 = G1 + G2 + G3$$

$$C4 = G1 + G2 + G3 + G4$$

$$C5 = G1 + G2 + G3 + G4 + G5$$

- 2) Calculating the Share in Total Sales of each Non-Cumulative Group, by subtracting the percentages of the Cumulative Groups:

$$g_1 = c_1$$

$$g_2 = c_2 - c_1$$

$$g_3 = c_3 - c_2$$

$$g_4 = c_4 - c_3$$

$$g_5 = 100\% - c_4$$

Where:  $c_1$  = Share in Total Sales of Cumulative Group 1 (Census Data)  
 $g_1$  = Share in Total Sales of Non-Cumulative Group 1 (Calculated)  
Etc...

- 3) Calculating the Total Sales of each Non-Cumulative Group:

$$S_1 = g_1 \cdot S$$

$$S_2 = g_2 \cdot S$$

$$S_3 = g_3 \cdot S$$

$$S_4 = g_4 \cdot S$$

$$S_5 = g_5 \cdot S$$

Where  $S$  = Total Sales Value of the Industry (Census Data)  
 $S_1$  = Sales Value of Non-Cumulative Group 1 (Calculated)  
 $S_2$  = Sales Value of Non-Cumulative Group 2 (Calculated)  
Etc...

- 4) Calculating the Average Firm Sales Value of each Non-Cumulative Group:

$$a_1 = S_1/4$$

$$a_2 = S_2/4$$

$$a_3 = S_3/12$$

$$a_4 = S_4/30$$

$$a_5 = S_5/N-50$$

Where:  $a_1$  = Average Firm Sales Value of G1  
 $a_2$  = Average Firm Sales Value of G2  
 $a_3$  = Average Firm Sales Value of G3  
Etc...  
 $N$  = Total Number of Firms in the Industry  
 $N-50$  = Number of Firms in G5 (Tail of the distribution)

The average sales of a group doesn't guarantee that all the firms within such group have sales below a given amount. But all the firms in the group have sales below the average of the group immediately above. The groups where all the firms have sales below a certain amount are those whose group immediately above have an Average Firm Sales Value lower or equal to that amount. For the purposes of this analysis, the "class of SMEs" in each industry is composed by all the groups in which all the firms sell for less than u\$s 100 million, i.e. by the groups whereby the Average Firm Sales Value of the group immediately above is less than u\$s 100 million.

#### Establishment Basis of Reporting and Size of Firms

The concentration ratios have been prepared from establishment reports. Under the establishment system, the shipments of a given company are distributed among all of the industries in which it has establishments. In our estimate of SMEs' sales in each industry, only the manufacturing establishments within that industry are taken into account in determining the size of firms. Consequently, the presence of SMEs in a given industry may be overestimated due to the presence of small manufacturing establishments belonging to big firms from outside the industry.

## CHAPTER III

### FORMS OF TECHNOLOGY TRANSFER

#### 1. Hypothesis from the literature

CEDREI's previous research (White and Campos 1986) reviewed a number of other studies that have found a significant relationship between the size of firms investing abroad, and their preferences towards equity control forms. The overall impression was that smaller firms tend to hold lower equity participation in affiliates in other countries (Stopford and Wells 1972, Tomlinson 1970, Ozawa 1985). The CEDREI and other studies also found that the environment "typical" of developing countries has a strong influence on the ownership strategies of smaller firms in particular. An exploration of the U.S. 1977 Census on direct investments abroad showed that, while the preferences of small and large firms did not differ with regard to investments in developed countries, they tended to vary with regard to locations in developing countries: smaller parents were more likely to adopt minority owned joint ventures than larger ones. These results were confirmed by Kohn using data from the 1982 Census (Kohn 1988). Ozawa found the same differential attitude among smaller Japanese foreign investors (Ozawa 1985).

The explanation about the differential impact of the developing countries' environment on the ownership strategies of SMEs is related to a couple of main and not always coincident factors. First, it is argued that many developing countries tend to restrict the level of ownership of foreign investors, and that such restrictions are less "removable" or negotiable for smaller investors which have less to offer in exchange, and less strength and time to bargain. Secondly, smaller firms, more dependent on

individual and family decisions, are more sensitive to the "distance" factor, either physical or cultural. The same reasons that may explain the higher concentration of overseas investments by SMEs in nearby countries may also explain their tendency to look for risk-minimizing modes, or mechanisms facilitating a lower exposure in unfamiliar locations such as those of many developing countries.

Yet in spite of their higher likeliness to adopt non-equity controlled forms, SMEs can still choose among licensing (or other arms-length forms of technology transfer) and minority joint ventures. Not enough evidence and theory is available with regard to this issue. The cost related and strategic considerations that explain their relative propensity to forego 100% ownership and to adopt minority joint ventures seem to be applicable to the case of technology agreements. Telesio found that firms with little experience in manufacturing abroad will generally value the production capabilities of local companies and thus will be more likely to license (Telesio 1984). Stobaugh observed in the petrochemical industry that when many firms own similar technology, the use of both licensees and joint ventures is more frequent (Stobaugh 1984).

Yet the use of technology agreements such as licensing depends on the type of technology transferred. In principle, such knowledge should be clearly identifiable and protected by exclusive and transferable rights. A survey of Japan's SMEs (Tokyo Chamber of Commerce, cited in Ozawa 1985) revealed a much higher utilization of equity rather than contractual forms for the transfer of technology, particularly to developing countries. Ozawa explained this pattern arguing that Japan's SMEs have comparative advantages in transferring human-centered (human-labor and organization embodied) technology, and standardized knowledge for which technology agreements are less justified, and that equity involvement facilitates "synergistic interactions" between SMEs and local companies.

Other authors have also argued that licensing presents policing and transaction costs which tend to be expensive (Contractor 1981); that unfamiliar partners (a typical situation of smaller firms and their foreign counterparts) would not easily become mutually reliable through mere contractual agreements, that is, without a closer involvement (Williamson 1975); that smaller firms lack experience in the formalization of knowledge through manuals and specifications, etc. (Wells 1983).

On the other hand, transactions of SMEs frequently involve single or "one shot" transfers of technology. Two different attitudes may follow from this circumstance, depending on the relative importance of the transfer for the suppliers and/or the recipients. The transaction might involve a "mainstream" knowledge of the SME and/or a high expected value of the revenues from its exploitation. A small, non diversified company may depend significantly from its only transfer abroad, and thus be willing to carry it out on an intra-firm basis. Or the transaction may involve a relatively low, short-term commitment on the part of a small company which is not willing, nor prepared, to develop a long-term relationship with the recipient party, in which case it is less likely to require an equity-based involvement. Many SMEs that receive unexpected demands from unknown firms in distant countries, or whose strategy of exploitation of such markets is based on exports which are suddenly challenged by import barriers, may be likely users of arms-length technology agreements.

## 2. Organizational mode and SMEs' basic features

The first important finding from the survey has to do with the variations of the organizational forms according to the size of the studied firms. As Table 14 indicates, the strong preference of SMEs for non-equity controlled firms is confirmed but, as interesting is the fact that a significant change in pattern can be identified for those firms of more than 300 employees. This result suggests that within those firms defined

as SMEs different capabilities exist and as a result different strategies as to preferred organizational forms can be detected.

**Table 14**  
**Forms of involvement by size of SMEs and previous international experience**  
 (Number of cases, in percentages)

	Contract	Minority joint ventures	Equity control	Total	Absolute figures
<b>Size of SMEs</b> (Nr. of employees)					
Less than 100	72%	19%	9%	100%	32
From 100 to 300	66%	23%	11%	100%	44
More than 300	37%	18%	45%	100%	38
Total	58%	20%	22%	100%	114
Absolute figures	66	23	25		
<b>Number of previous foreign production ventures</b>					
None	66%	18%	16%	100%	44
1-3	39%	26%	35%	100%	23
More than 3	25%	0%	75%	100%	4
Total	55%	20%	25%	100%	71
Absolute figures	39	14	18		

The same can be said with respect to the previous international experience of SMEs. In fact, as Table 14 shows, those firms that had at least one previous foreign operation — be it an equity or non-equity venture — were those inclined to adopt equity rather than contractual forms. This result in part derives from the growing confidence that firms with previous experiences gain as to the best way of organizing the international transfer of resources. At the same time, as has been indicated, these results are also explained by the fact that for a group of sample suppliers the opportunity to participate in the project came as a proposal from a recipient firm already

operating in the host country. Very frequently, the type of organizational form preferred by these firms was a non-equity arrangement.

This statement is supported from the evidence on the correlation between the origin of the initiative regarding the project and the outcome in terms of organizational mode. Table 15 shows conclusively that when the initiative at that respect came from a host country firm, the most frequent result by far — 85% — was a licensing agreement. On the other hand, when the initiative was a responsibility of the SME a large share — 51% — of the cases adopted equity controlled forms. In other words, and this is a point worth emphasizing, local initiativeness appear as a much stronger determinant of the organizational forms than SMEs initiativeness.

**Table 15**  
**Forms of involvement and origin of initiative of the transfer**  
(Number of cases, in percentages)

Forms	Initiative				Total	Absolute figures
	Local	SME	3rd party	Mixed		
Contract	85%	16%	100%	100%	59%	66
Minority joint ventures	12%	33%	0%	0%	20%	22
Equity control	3%	51%	0%	0%	21%	24
Total	100%	100%	100%	100%	100%	
Absolute figures	65	43	2	2	112	

The type of form has of course to do also with the characteristics of the recipient countries, and the motivations of the SME behind its participation in the venture. With respect to the first aspect, Table 16 shows very significant differences: while almost all cases in Argentina had to do with licensing agreements, the opposite occurred with those in Singapore. Brazilian and Mexican cases, on the other hand, included around a third of equity controlled ventures while no one of this type was identified in India and Korea ventures.

Such differences reflect in part the mixed impact of two different factors: the size and growth of the recipient economy, which is supposed to influence positively the tendency to use intra-firm modes, and the existence or not of ownership or other restrictions on alternative channels or modes of technology transfer. The influence of the policy and legal factor is dramatized in the cases of India and Korea, on the one hand, and Singapore on the other. Policies and regulations in the former make virtually impossible or very difficult for foreign investors to hold majority control, while in the latter no such restrictions exist. In these cases, the legal factor seems to have much more impact than any economic consideration. On the other hand, Argentina, Brazil and Mexico have had, during the period examined, relatively restrictive norms on both investments and technology imports. In Brazil, however, restrictions are stricter for the authorization of technology agreements than for foreign investments, while in Mexico, the "mexicanization" rule was liberalized only recently. The case of Argentina is an exception. The overwhelming weight of technology agreements undoubtedly expresses economic rather than legal factors, and particularly the lack of attractiveness of this country for risk investments in recent years.

As could be predicted according to the received theory, those SMEs which were mainly attracted by the growth prospects of the recipient country, opted for equity control strategies rather than arms-length agreements (see lower part of Table 16). The same occurred with respect to SMEs whose affiliates were designed to serve as platforms for exporting to other countries. The need to assure a tight control of the production as well as marketing functions led firms to use that form. In contrast, firms reacting to import restrictions were less interested in majority ownerships, and most of those primarily motivated by outside proposals transferred technology through licensing agreements.

**Table 16**  
**Forms of involvement, recipient countries, and motivations to choose them**  
 (Number of cases, in percentages)

	Contract	Minority joint ventures	Equity control	Total	Absolute figures
<b>Recipient countries</b>					
Argentina	95%	5%	0%	100%	20
Brazil	39%	22%	39%	100%	18
India	71%	29%	0%	100%	31
Korea	83%	17%	0%	100%	12
Mexico	35%	35%	29%	100%	17
Singapore	13%	6%	81%	100%	16
Total	58%	20%	22%	100%	114
Absolute figures	66	23	25		
<b>Factors</b>					
Growth	14%	38%	48%	100%	29
Protective measures	33%	42%	25%	100%	12
Re-exporting	50%	0%	50%	100%	6
Gov.inducement	67%	0%	33%	100%	3
Outside proposal	87%	10%	4%	100%	52
Nationals same origin	0%	100%	0%	100%	1
Other	67%	0%	33%	100%	3
Total	57%	21%	23%	100%	106
Absolute figures	60	22	24		

An interesting pattern emerged from the distribution of the technology transfer operations over the period of about 2 decades in which the 114 cases were initiated. In effect, arms-length technology agreements tended to increase over the years, particularly after the 71-75 period, and wholly owned subsidiaries and majority owned joint ventures tended to decrease their share, particularly since the early eighties. This pattern seems to reflect the existence of various factors and forces. The decrease in the percentages of equity in the post seventies transactions might be explained in part by the lower attraction of three or four of the recipient countries for foreign investments in general,

given the emergence of serious problems in their economies (particularly in Latin America). Yet after controlling for the recipient country factor, the same trend towards a larger use of non-equity forms, and technology agreements in particular, was noticed in Korea. Unfortunately the data at hand does not allow to verify if the current trend of liberalization of host country ownership regulations in countries such as India, Korea, Mexico and Argentina has influenced a new wave of SMEs with equity-controlled foreign participation.

### 3. Modes preferred and implemented

Sample SMEs were asked about their initial preferences with regard to forms of involvement, and their reasons thereof. They were also asked if they had to change their choices in the outcome, and why, in case they had. In 50% of the cases the SMEs had envisaged a technology agreement with a local enterprise; in 21% they were willing to take a minority share in a joint venture; in 6% they wanted more than 50% ownership in a joint venture, and in 23% of the cases they preferred a wholly owned subsidiary.

The main reasons to select technology agreements as an organizational form were costs, in terms of lack of sufficient resources needed or high risks perceived in the project (56% of the cases); better or faster access to the local market (16%); and legal requirements, or conditions established by the recipient party (16%).

The exploration of possible firm-specific factors revealed that for smaller SMEs, corporate policy and "access" reasons were more important than for larger SMEs, which gave more importance to legal factors. This finding suggests that the former tended to view the technology agreements with more sympathy than the latter, which in the absence of legal restrictions probably would have preferred, or would have been prepared, to get more equity participation than what they were allowed to take.

The data also revealed that cost and risk considerations were relatively more important for the technology agreements of SMEs with lower levels of internationalization and of R&D expenditures, as well as for those whose main motivations for the transfer of technology were outside proposals, government inducements or import protection measures to be circumvented. Cost reasons were concentrated on transfers to Latin America and Korea. Legal reasons and access to the market were much prevalent in SMEs with more international experience, higher R&D expenditures, and attracted by the size and growth of the host countries' markets. Legal factors were concentrated in projects in India.

The preference or acceptability of minority joint ventures was explained by the suppliers on the basis of the main following reasons: a) better access to the local market (40% of the operations); b) legal factors (33%); c) access to local financial resources (7% of the cases). It was evident that the contribution of the local partners and particularly their knowledge and connections in the recipient countries were a major reason for seeking or accepting minority shares. With regard to the legal reasons, they correspond to cases located in Brazil, India and Mexico, where government policies mandate or encourage such forms of foreign investment. Legal restrictions were also more significant for R&D intensive SMEs, and financial considerations for the smaller and less internationalized suppliers.

Subsidiaries and majority owned joint ventures were basically preferred for two basic, highly related factors. About half of the suppliers declared that such was the normal policy of the company. The other half recognized that the objective was to secure the control of the technology transfer. These cases were typical of more innovative firms and of those which, as said, defined an intensive export role for their recipients.

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**Box C**  
**The advantages of non-equity forms**

The empirical evidence of cases under study shows that the "non-equity forms are the most frequent contractual solutions adopted by Italian SMEs transferring technology to LDCs.

Several factors may explain this behavior. On the side of the firm, non equity forms sharply reduce investment outlays and the risks involved; this holds particularly true as small firms are concerned, whose global amount of financial resources is quite limited. Moreover, in the case of several LDCs, the risks of direct investment increased during the '80s, due to the worsening of their financial and economic situation.

Non-equity forms permit a more flexible strategy, reducing the global risks and enhancing the possibilities for the firm going international to withdraw from the deal.

This behavior is also due to technology import policies of some countries (i.e. India and Korea) characterized by the careful management and control

over the process of importing and assimilating technical knowledge via selective use of FDI and non-equity forms complemented by the development of indigenous technological capabilities.

For smaller firms the importance of cooperating with a local partner is very significant. Both via joint equity ventures (as seen above SMEs show a larger proportion of joint ventures over their total foreign investment) or, more frequently, by non-equity agreements, smaller firms try to benefit from the skills and the knowledge of their partner. In a sense, there is always an exchange of "complementary assets": even when the deal involves a "pure" transfer of technology, some knowledge is acquired from the partner in exchange; when the deals are more articulated, this exchange is richer and more complex.

Falzoni, A. and Viesti, G.,  
CEDREI-IDRC, Vol.I, 1990.

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It is interesting to point out that SMEs in 90% of the cases declared to have celebrated the arrangements that they had originally envisaged. Table 17 indicates that those that looked for technology agreements, minority joint ventures or subsidiaries indicated that in most cases they obtained what they wanted. But, of course, this is an ex-post opinion, and taking into consideration that in most cases several years had elapsed since the project was initiated, should not be given to much weight. In any case it appears as if in only two ventures the initial choices for licensing agreements had to be changed for minority joint ventures — the local partner insisted on a greater involvement of the supplier — or a wholly owned subsidiary, because the negotiation with a potential licensee failed; a project for a minority joint venture ended up in a licensing agreement, and an initiative for setting up a subsidiary had to be implemented as a minority joint venture. In contrast, 3 of 4 projects of majority owned joint ventures

had to be changed; two of them for minority shares and the other one for a wholly owned subsidiary, because the potential local partner's proposal was considered unacceptable.

**Table 17**  
**Initial choice of form of involvement and final outcome**  
(Number of cases, in percentages)

Form adopted	Initial preference				Total	Absolute figures
	Contract	Minority joint venture	Majority joint venture	Subsidiary		
Contract	94%	7%	0%	0%	49%	34
Minority joint venture	3%	93%	50%	6%	26%	18
Majority joint venture	0%	0%	25%	0%	1%	1
Subsidiary	3%	0%	25%	94%	24%	17
Total	100%	100%	100%	100%	100%	
Absolute figures	35	15	4	16	70	

U.S. and U.K. firms were those most affected by the changes (29% and 22% of their projects respectively), and Korea was the recipient country where the initial plans had to be altered more frequently (27% of the cases). In more than half of the cases, local governments (those of India and Korea) were the specific factors for the change of forms. Negotiations with local recipients and other, usually unexpected reasons, motivated the remaining changes.

A somewhat unexpected high share of the intra firm technology transfers took place by the establishment of new companies in the recipient countries. Only 10% of the cases were carried out through the purchase of shares of existing companies. This finding may seem surprising given the already discussed propensity of small firms to complement their relative scarce resources with those of ongoing local companies. Yet a high percentage of the "greenfield" investments made by the SMEs (43%) were

organized in association with local partners, and in most of these cases, the latter preserved the equity control of the joint ventures.

All the wholly owned subsidiaries in the sample were established by the creation of a new company, except for one case, which resulted from a takeover of a local firm. The reasons for setting up wholly owned ventures have to do with some firm-specific advantages (size, international experience) and with a number of variable circumstances of each case, such as the origin of the initiative, the SME's motivations to undertake the project, or the lack of suitable local partners. The desire to secure control of the operation was the main reason reported by the suppliers.

The few cases in which the entry method was the purchase of shares of an existing company or the participation in a capital increase represented, except for the case just mentioned, the association of SMEs in minority-owned joint ventures. Also with one exception, the purchase of shares was a behavior observed only in the case of German SMEs (75% of the investments of this origin entered in this way) and for projects in Argentina, Brazil, Mexico and Korea. Most of these SMEs had over 300 employees and a high level of internationalization, but significantly, they had no previous antecedents in the respective recipient countries. In one case, the reason for this method of entry was that the recipient was a company of the same national origin.

In conclusion, SMEs that choose to invest rather than license show a high propensity to undertake greenfield operations (rather than joining or taking over ongoing ventures), with all the implications of this entry method in terms of organization of totally new operations; but in a significant proportion of these cases the ventures were organized as joint ventures with already established companies. The tendency to undertake greenfield ventures appears associated to the sophistication of the technology transferred and the role of the recipient as a re-exporter of goods to developed country markets.

#### 4. Synthesis

As a whole studied SMEs participated in production ventures in developing countries through non equity forms much more frequently than has been portrayed by the literature in relation to large firms. Their lack of sufficient resources and of international experience explains this outcome. But it would be misleading to conclude that always those modes are preferred by these undertakings. In fact, the evidence from this study has demonstrated that the organizational mode adopted has much to with factors totally or partially out of control of SMEs.

Specifically, the data gathered shows that the origin of the initiative regarding the venture heavily determined the organizational mode employed. When the project was put before the SME by the domestic firm established in a developing country that ended up as technology recipient, the result was, in most cases, a licensing agreement. A more balanced outcome occurred when the SME itself was the initiator of the project. In addition, the preference for equity forms increased the larger the international experience of SMEs, and the higher the sophistication of the products they manufactured. To a greater extent than large transnational corporations, SMEs appear to be more dependent of the institutional setting existent in developing countries as regards regulations on foreign direct investment or technology contracts.

## CHAPTER IV

### THE TECHNOLOGY TRANSFER PROCESS: CONTENTS AND CHANNELS

This Chapter is devoted to a presentation of some of the most relevant issues that have to do with the actual transfer by SMEs of their skills to host countries and the role of recipient firms in this process. It will first describe the four main channels used and indicate the more frequent type of firm in developing countries that received them. Afterwards, a discussion on specific aspects of the provision by SMEs of know hows through the most frequently used channels is put forward.

#### 1. Contents of the transferred technologies

Product technology — namely, technical knowledge for the goods to be manufactured in accordance with given specifications — was exclusively negotiated in 23% of the 114 technology transactions recorded by our research. Other one-third of technology deals involved both product and process technology, (manufacturing methods, organizational practices, quality control, etc.). Plant technology — which implied the knowledge and information required for the setting up of a manufacturing establishment — jointly with either product or process technology was at stake in only 5% of the technology transfer cases. Finally, whole sets of know hows, that is containing product, process and plant technology were the subject matter in almost 40% of the operations.

As emerges from table 18, the content of the know-hows was transferred through the provision of technical assistance, blue-prints, critical parts or components, and special equipment. As it comes out, both technical assistance and blue-prints were

included in almost all technology transactions. However, while exports of special equipment were mostly attached to the transfer of all-included packages, imports of parts were decreasingly distributed from amongst those cases for which more inclusive and complex packages to those for which only product technology was transferred.

**Table 18**  
**Know-how contents and means of technology transfer**

Classification of cases by know-how content of the technology transfer	Percentage of cases in each grouping using the respective technology transfer instrument				Number of cases
	Technical assistance	Blueprints	Critical parts	Special equipment	
Product	100%	100%	38%	8%	26
Product & process	100%	97%	47%	21%	38
Plant & product & process	100%	100%	50%	50%	6
All-included packages	100%	95%	67%	69%	42
All cases	100%	97%	53%	38%	112
Absolute figures	112	109	59	42	

As it could be anticipated, the contents of the know hows transferred were strongly associated with the organizational form of the ventures. Those cases in which complete packages predominated were usually related with foreign equity controlled projects, while those in which only product or product and process know hows were provided, licensing agreements prevailed.

The distribution by recipient countries reveals strong differences (see table 19). The transfer of all three know hows predominates in Singapore; in Argentina, Korea and Mexico the combined transmission of product and process know hows is more frequent; while in India almost 42% of the transactions involved product technology exclusively. These various patterns to a large extent seem to reflect the different modalities and criteria of intervention of the governments of recipient countries in the technology transfer process. The open policy of Singapore with regard to the inflow of foreign investment and technology, for example, explains the more diversified nature of the

technology transfers to this country while the partial transfers to Korea seem to be associated to the existence of institutional restrictions and technology transfer controls. Yet the table shows that the relationship between those restrictions and the scope of the transfer is not very clear. Limited transfers were found in many cases of projects in countries whose policies would have in principle admitted a larger involvement of the suppliers. Even in the case of India, which has applied restrictive policies over the last two decades, a high share of cases involved the joint transfer of the three basic know hows, which suggests the existence of some flexibility either in government practices or in the SMEs' attitudes vis a vis the control of their technological advantages.

**Table 19**  
**Contents of know-hows of the technology transfer by host country**  
(Nr. of cases, in percentages)

	Know-hows content				Total	Absolute figures
	Product	Product & process	Plant & product or process	All-included packages		
Argentina	25%	70%	--	5%	100%	20
Brazil	28%	22%	6%	44%	100%	18
India	42%	13%	6%	39%	100%	31
Korea	25%	58%	8%	8%	100%	12
Mexico	--	47%	--	47%	100%	17
Singapore	--	6%	6%	88%	100%	16
Total	23%	33%	5%	39%	100%	
Absolute figures	26	38	6	44	114	

## 2. Technology transfer through blue prints and technical assistance

In what follows a detailed analysis of some of the issues related with the utilization by SMEs of the two most frequently used channels of technology transfer will be pursued.

a) Blue prints

Industrial firms are obliged to maintain an accurate record of the specifications of the fabricated products as well as of the different phases and procedures followed to manufacture them. Usually this record is translated into blue prints and instructions that workers and technicians at the shop floor are supposed to follow as precisely as possible. But the extent in which all relevant specifications are formalized in drawings and written instructions varies among firms.

Two main factors are particularly relevant at this respect. The first one has to do, as Teece has indicated, with the age of the technology (Teece 1977). Relatively more stable know hows are more easily translated into written specifications than those that are going through a continuous change. The second one, has to do with the firm's behavior at this respect. Some firms prefer to follow strictly detailed formalized instructions while others tend to rely more on the accumulated knowledge and experience of its workforce and technicians. As it will be taken up below, this last feature has also to do with the type of industry the firm is established in.

There are a couple of strong reasons to suggest that the level of formalization of SMEs as a whole is, *ceteris paribus*, lower than the one of large firms. The first one is related to the fact that SMEs usually operate one manufacturing plant. As a result the elaboration of detailed instructions needed to ease communications among a complex network of production facilities as in the case of large firms, is not so demanding. Furthermore, the usually small number of operatives and technicians in the shop floor at SMEs, makes the exchange of tacit knowledge easier than in larger establishments.

On the other hand, SMEs operate frequently in a series of industrial activities in which "custom-made" is the prevalent mode of production organization. The need to flexibly respond to their clients demands leads firms that operate under this mode to a

permanent adjustment of the specifications of the fabricated products which, in turn, not always are translated into written instructions.

To analyze this topic in the present survey, recipient firms were asked to rate the quality of the blue prints delivered to them by the SMEs. More specifically, they were requested to indicate if they considered them understandable and clear enough to operate with them or if they needed the technical assistance of the supplier to this end. As a whole, 10% of the recipients indicated that blue prints were not sufficiently clear. But this proportion increased to 16% when only technical agreements were considered.

b) Technical assistance

All studied cases included the provision by the SME of technical assistance to the recipient firm. This is not surprising. It is well known, that only part of the knowledge and skills controlled by a firm are formalized in written instructions or incorporated in special tools and equipment. The rest is "embodied" in the firm's personnel. As a consequence, there is no way of really transferring production knowledge from one firm to another without the involvement of such people.

Of course, the relevance of technical assistance may vary in different circumstances, and particularly according to the extent of the formalization efforts conducted by the firms. Some suppliers may develop a very precise method to "translate" product specifications as well as manufacturing instructions into written, codified procedures, while others may base their daily operations in a larger extent on the experience accumulated by its technicians, as well as blue-collar workers, after years of performing similar tasks.

In the same vein, technologies which are in a "state of flux", are usually much less codified than those which are relatively more settled. The former happen to be much more difficult to transfer internationally than those from which their basic "routines" and main features have not undergone major changes for some time . As Teece has put it, this is so because "engineering drawings are more likely to be finalized and the fundamentals of the technology stand a better chance of being more fully understood" (Teece 1977).

Specifically in relation to the subject of study of this report, it is reasonable to suggest that SMEs would experience, in general, some constraints when it comes to transfer technologies through technical assistance. In fact, while blue prints, in principle — if they can be supplied "from the shelf" — can be a low cost channel to transfer technical resources, the commitment of personnel to assist a firm in a foreign country may imply putting some "strain" to SMEs, by definition, limited technical human capabilities. It has to be underlined, that for an SME dispatching a small group of engineers or technicians entails — particularly if for a relatively long time — suffering a drain in its human resources which cannot be so easily handled as in the case of a large corporation.

The data from the survey indicates that in 65% of the studied cases technicians from the SME were sent to the recipient firm. The extent of this performance varied mainly with the nature of the project and the degree of control of the SME over the host country firm. As table 20 shows, large differences emerged at this respect according to the type of know hows transferred by the SME. When a complete set of the latter were transmitted — that is, product, process as well as plant technologies — the engagement of SME technicians in the foreign project was greater than when only product know hows were transferred.

This result derives, of course, in part, from the fact that it is relatively easier to transmit the relevant know hows without the direct participation in the recipient country of SMEs technicians, when they have to do with one specific variety and not with a wide spectrum of skills as is the case when complete manufacturing plants have to be established from scratch. But this is one side of the coin. The other important aspect — and this topic will be taken again below — is that in the studied cases when a complete set of know hows was transferred the usual situation was one in which no pre-existent recipient firm performed the role of absorbing and assimilating those technologies.

SMEs got involved in the transfer of their human resources to the recipient firm in a larger extent when they had an equity participation in the latter than when they only transmitted their skills through licensing agreements (see table 20). Again this in part has to do with the strong association already referred to between organizational modes and contents of the transferred technologies. But the greater involvement of SMEs technicians has also to do with the role assigned to the recipient firms by those undertakings. This can be illustrated regarding the export behavior of the former. In fact, in those cases in which recipient firms had a regular export program it was relatively more frequent the engagement of technical personnel from the SME in the host country than when the project was aimed at supplying the latter's domestic market. The more tighter control on manufacturing practices on the part of SMEs on those export oriented recipients explains this much greater involvement.

It comes as no surprise, given the already referred correlations between organizational modes and recipient countries, that the involvement of SMEs technicians varied significantly according to the host countries. As table 20 indicates, while over 80% of the Mexican and Singaporean cases had received technical personnel from the SMEs, the corresponding figure was of only 30% in the case of Argentina and it was for India a few points below the average for the total sample.

**Table 20**  
**Technicians sent from SME to local firm by technological content, organizational form,**  
**export behavior of recipient, host country and previous R&D efforts to obtain the technology**  
(Nr. of cases, in percentages)

	Technicians sent from SME to the Recipient Firm			Absolute figures
	Yes	No	Total	
Technological content				
Product technology	44%	56%	100%	25
Product & process tech.	55%	45%	100%	38
Plant & product or process	75%	25%	100%	4
Product, process & plant technologies	84%	16%	100%	44
				(N=111)
Organizational form				
Licensing agreement	53%	47%	100%	66
Minority joint venture	80%	20%	100%	20
Equity controlled venture	84%	16%	100%	25
				(N=111)
Export behavior of recipient				
No exports	58%	42%	100%	26
Infrequent exports	65%	35%	100%	23
Exports on a regular basis	77%	23%	100%	26
				(N=75)
Host country				
Argentina	30%	70%	100%	20
Brazil	71%	29%	100%	17
India	60%	40%	100%	30
Korea	73%	27%	100%	11
Mexico	88%	12%	100%	17
Singapore	81%	19%	100%	16
				(N=111)
The recipient tried to obtain the same technology by R&D efforts				
Yes	23%	77%	100%	13
No	68%	32%	100%	40
				(N=53)

As anticipated, the existence of previous local technical capabilities on the part of the recipient firm has had a strong impact on the extent in which SMEs technicians travelled to the host country to deliver their skills. In fact, table 20 shows that great variations exist according to the degree in which at the recipient firm efforts were conducted to develop the know hows that were finally imported from the SME. In other words, when the recipient firm had invested time and resources to try to solve some specific technical problems and/or come out with a given product variety, they were in less need to receive technicians from the suppliers. They just went on for very detailed pieces of information and for that purpose a more efficient and cheaper procedure was to obtain the corresponding blue prints and send to the SME their own technical personnel.

In fact, technical assistance was also provided to recipient's personnel by SMEs in their home country plants. In 81% of the studied cases personnel from the recipient travelled to receive technical instructions. As with the previous mode, the extent and significance of this procedure varied between firms. Some cases included the stay of recipient firm's personnel for up to two months while in others their permanence could be counted in days. At the same time, it was evident from the interviews that the organization and formalization of the transfer of skills varied according to the home country of the SME (see Box D). But as a whole, the impression conveyed from the sample cases was that the recipient technicians had to have a reasonable prior level of knowledge to profit from their stay at the SME headquarters. The "high mark" which, as it will be seen, usually SMEs gave to the role performed by recipient technicians tends to support this point.

Of course the above statement applies in particular to those cases in which licensing agreements were celebrated. On the one hand because in them recipients had usually some basic technical capabilities to begin with. On the other, because these

firms were willing to pay limited amounts in terms of royalties and as a consequence SMEs were inclined to restrict the total amount of know hows supplied.

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**Box D**

**Flow of Personnel Between Parent and Subsidiary: Japanese vs European Firms**

All Japanese firms sent local technicians to Japan for training. They do so not only to transfer technical skills but also to familiarize local technicians and engineers with the corporate culture of the parent company. They believe head office training will help local technicians and engineers to work better with the head office.

Japanese SMEs also sent their engineers and technicians to their Singapore plants, in most cases for periods of up to three months. Compared to SMEs from other industrial countries, Japanese SMEs are more likely to encourage a two-way flow of personnel between the head office and its subsidiaries, a practice that improves cooperation and understanding between the head office and the Singapore subsidiary.

European firms, on the other hand, depend more on local on-the-job training, especially when introducing low-tech products. Two reasons explain the lower reliance on home country training among European firms. First, home country training if it involves many persons is more costly for them than sending their technicians to Singapore. Second, European SMEs view home country training mainly in technical terms and do not see it as an important element in fostering company spirit and cooperation between themselves and their Singapore plant.

P.E. Fong and A. Paloheimo,  
CEDREI-IDRC, Vol.II, 1990.

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The Argentine experience is appropriate to mention at this point. In fact, practically all cases celebrated by studied SMEs in Argentina were circumscribed to licensing agreements, themselves entered mainly in product and process know hows. The relatively low total income that SMEs could expect to receive from their transfer, led recipient firms to carry out by themselves the task of obtaining in situ (that is, in the home country) the relevant know hows. It was not rare that one or two technicians travelled to the SME headquarters to absorb and actualize the imported know hows. It is interesting to underline that in many of these cases the personal relationship between entrepreneurs and technicians from both firms allowed the process to be carried out smoothly. It is probably reasonable to point that this type of exchanges heavily based

in "gentlemen agreements" are a feature of the technology transfer by SMEs which would be rarer to find when dealing with large transnational corporations.

It is interesting to indicate that the judgement on the role played by local technicians was not severely biased by the source of the information. In fact, it would be natural to expect recipients highly grading their own staff's role in the transfer process. A more neutral statement would be anticipated for the SMEs own judgement. As table 21 shows on the whole a similar pattern emerges. Furthermore, in all those cases that were "matched" the opinions of suppliers and recipients were notably similar.

**Table 21**  
**Role of local technicians by source of information**  
**and organizational form of technology transfer**  
(Nr. of cases, in percentages)

Source of information	Local technicians' role				Total	Absolute figures
	Very significant	Significant	Fairly significant	Not significant		
Recipient	44%	39%	15%	2%	100%	41
Supplier	59%	4%	33%	4%	100%	27
Both	58%	24%	9%	9%	100%	33
Total	52%	25%	18%	5%	100%	
Absolute figures	53	25	18	5	101	

The highly appreciated role of local technicians is explained essentially by the limited transfer capabilities of SMEs. In fact, it came out clearly from many interviews that the suppliers preferred as far as possible to use local-recipient firm's personnel that allocating their scarce technical resources directly to the transfer process. Of course, this outcome in part depended as it was seen, on the aims of the SME as to the overseas venture, but it also had to do with the objective restrictions of many of them to transfer technology to developing countries.

To deepen this issue, recipient firms were asked to evaluate the transfer capacity of the suppliers: 44% of those that responded, rate it as "good", while the rest divided by half their opinions in what they considered a "fair" or "poor" capacity. The interesting finding to refer here is that those judgements were found to be strongly correlated with what recipients thought was their technicians role in the transfer process (see Table 22). In other words, recipient firms without making an explicit linkage between both variables, view the latter's role as a substitute of the SMEs limited transfer capability.

Respondents from developing country firms made their assessment of SMEs' transfer capabilities according to their evaluation of the technology transfer experience they have gone through. In other words, their view of SMEs' referred capabilities was strongly determined by a single case, and this one, it could be argued may not be a good indicator of the suppliers potential to transfer know hows internationally.

In fact, SMEs may be not inclined to get deeply involved in a given venture in developing countries because of factors which have not to do with their transfer capabilities. In this regard, it should be taken into consideration that some SMEs considered the present and expected income from the venture as low in relation to the efforts that the transfer of know hows implied. In other words, they provided the recipient with a limited amount of technical resources because the costs of supplying more would clearly surpass those earnings. It comes out as no surprise that in these cases recipients had to fill the gap of the insufficient direct provision of know hows by the SME, with their own technical efforts.

But it would be misleading to conclude that SMEs transfer capabilities have only to do with factors such as those referred. In fact, from the survey it came out that the

level of internationalization of SMEs measured by a constructed index<sup>1</sup> — which is a good proxy as to the extent of experience of these firms in transferring their know hows to foreign markets — was strongly related with the recipients judgement of SMEs' transfer capabilities. As Table 22 shows (unfortunately information is available only for cases for which questionnaires from both supplier and recipient were received), those capabilities were rated as "good" in 86% for those SMEs that had a higher degree of internationalization while the corresponding figure for those with a low degree was 39%. Furthermore, no highly internationalized firm was graded with a "poor" transfer capability while this occurred with 33% of those with a low international experience.

To end this section, it is appropriate to recall that technology transfer implies essentially the transmission of knowledge and skills from personnel working at the SMEs to technicians and personnel employed in recipient firms. In a way then, the significance of this process has much to do — and particularly so in social benefit terms — with the number of people involved and the extent in which the transmission of technology is made in a systematic or unsystematic manner. Few mechanisms can be considered more fruitful for developing countries than the one that implies training workers and technicians in new manufacturing skills and procedures.

The results of this survey at first glance could lead erroneously to a not particularly stimulating conclusion. In fact, only in 14% of the cases recipient firms declared that a special training program was carried out. But as could have been expected, the propensity to undergo training programs was strongly related to the contents of the know hows transferred as well as to the existence or not of a recipient

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<sup>1</sup> The index was constructed in a way that gave licensing agreements celebrated worldwide by SMEs 1 point while equity-based ventures were given 2 points. "Low" involvement means a firm having a score of 4 points or less, "medium" from 5 to 8 points, and "high" from 9 points onwards (i.e. a "high" degree may result from an SME having 9 technology agreements, or 4 direct investments and 1 agreement).

firm capable of absorbing the imported technologies. When this factors are taken into consideration the picture changes significantly.

**Table 22**  
**Local recipients, evaluation on the transferring capabilities of the foreign technology supplier**  
**by role of the local technicians, recipient's previous experiences acquiring foreign technology,**  
**and level of internationalization of the supplier**  
(Nr. of cases, in percentages)

	Evaluation			Total	Absolute figures
	Good	Fair	Poor		
Role of the local technicians					
Very significant	24%	38%	38%	100%	29
Significant	56%	19%	25%	100%	16
Fairly significant	63%	25%	13%	100%	8
Not significant	100%	--	--	100%	4
Total	44%	28%	28%	100%	
Absolute figures	25	16	16	57	
Previous experiences acquiring foreign technology					
None	33%	44%	22%	100%	18
License agreements	33%	8%	58%	100%	12
Joint ventures	17%	67%	17%	100%	6
Both	50%	--	50%	100%	2
Total	32%	34%	34%	100%	
Absolute figures	12	13	13	38	
Level of internationalization					
Low	39%	28%	33%	100%	18
Medium	75%	13%	13%	100%	8
High	86%	14%	--	100%	7
Total	58%	21%	21%	100%	
Absolute figures	19	7	7	33	

Table 23 illustrates this point. As can be observed, in 43% of those cases in which the SME had an equity control over the recipient a training program had been

implemented. This figure is a more proper one to take under consideration, since it relates with a sub-set of cases for which workers and technicians training often constitutes a prerequisite to allow the project to take off.

**Table 23**  
**Implementation of a training program by ownership pattern**  
**of technology transactions**  
(Nr. of cases, in percentages)

Ownership pattern of technology transactions	Training program		Total	Absolute figures
	Yes	No		
Licensing agreements	12%	88%	100%	66
Minority shareholding by SME	32%	68%	100%	22
Equity controlled by SME	43%	57%	100%	23
Total	23%	77%	100%	
Absolute figures	15	86	111	

The important point to underline here is that the data does not support the hypothesis according to which SMEs could be looked upon as necessarily weaker agents at the time of transferring capabilities through training. In fact, taking into consideration the essential limited resources of these firms it could have been thought that they would not be usually in a condition of carrying out systematic efforts to train personnel of recipient firms. Furthermore, given the large supply of labor in developing countries, it could have been anticipated that SMEs (as well as recipient independent firms) would have had no (or very limited) inducements to carry out this investment in human resources, with the additional risk of the trained workers moving to other firms. Although certainly a particular case, it is interesting to pin point that for Japanese SMEs that transfer skills internationally the training of host country personnel is probably one of their most salient features. Ozawa, who has worked extensively on this topic, presents his findings in a very clear-cut way (see Box E).

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**Box E**  
**Japanese SMEs: transfer through training**

What the developing host countries receive from Japan's small multinationals, then, are mostly basic shop-floor production technologies (assembly, fabrication, and processing skills that can be transferred to local employees through training).

This production-skill orientation means that what may be called "human-labor-embodied" technology is involved and that personnel training (on-the-job training of managers, foremen, and workers) is the key mechanism for transferring job-specific skills and know-how. Yet training is a form of investment in labor, involving risks, especially when local labor is foot-loose (i.e. highly mobile between firms).

As I emphasized elsewhere, human-labor-embodied technology and its transfer often tend to be given much lower priority than technologies that are physically-centered or non-human-centered, such

as plant-embodied, input-embodied and product/process-embodied technologies, particularly in developing countries. Moreover, human-labor-embodied technology is essentially internalized, not in the firm but in individual workers, that is, if workers quit, the firm loses such technology or, worse still, loses it to its competitors. Hence there is less incentives to emphasize the development of human-labor-embodied technology and much greater incentive to solve the productivity problem in terms of physically-centered approaches.

Besides, given the abundant supply of labor services in the developing countries which can be hired at relatively low wages, it is rather difficult to see local workers as suitable objects of investment.

T. Ozawa, CEDREI-IDRC, Vol.I, 1990

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### 3. Synthesis

Studied SMEs have participated in projects that have entailed the transfer of different know hows either separately or in a set. That is, they have shown that they are capable of transferring product, process and plant technology to developing countries through various combinations according to the demands put to them and their own preferences at this respect. To proceed likewise SMEs have used in practically all cases two channels: blue prints and technical assistance.

From the gathered evidence it came out that these firms appear to face some constraints at the moment of relying mainly in blue prints for transferring their know hows internationally. It was, then, not surprising to find out that technical assistance appeared as an another channel extensively used. The interesting aspect to emphasize,

is that technicians from recipient firms appear to play a crucial role in many of the cases studied. SMEs transfer performance was in many of them circumscribed to help the latter understand the main features of the relevant know hows by receiving them in the home country plant.

On the other hand, those SMEs that had a clear cut definition of the role that their affiliates abroad should play, showed that they were in a position of carrying out significant efforts in relation to upgrading the recipient's personnel skills. Training of the local work force, for example, contrary to what could be expected, was detected in various cases of SMEs that decided to put up an equity controlled project. This outcome was reinforced when the recipient firm's output was meant to be placed in world markets.

## **CHAPTER V**

### **ADAPTATION OF THE IMPORTED TECHNOLOGY**

One of the first ideas that arise, almost intuitively, in relation with the topic of the role of smaller firms in the transfer of technology to developing countries, is that the know hows of these firms are closer to the socio-economic conditions prevailing in the Third World. According to this view, smaller firms established in developed countries, as a whole, tend to employ a greater amount of labor per unit of output than large firms, and tend to use smaller scale and simpler production techniques than the latter, features all of them which seem to be particularly suitable for developing countries.

To tackle this issue its necessary to put forward some clarifications. On the one hand, the discussion on the suitability of technologies can be carried out with different sets of firms as units of analysis. It is possible to compare some basic feature of the population of SMEs and of large firms of developed countries — say, their relative intensities in the use of labor — and conclude that since the former as a whole employ more workers per unit of output, know hows originating from that population are more suitable for countries with a large endowment of labor relative to their capital endowment.

A different perspective is to go along with this exercise but only for those firms that have actually transferred their know hows to developing countries. In other words, to analyze the relative suitability of the technologies of those smaller firms that have participated as suppliers of those resources.

In this report only the latter are studied. Thus, the reference as to the suitability of their assets in terms of developing countries cannot be generalized to the overall

population of SMEs. More so, as has been shown, there are strong reasons to argue that the set of SMEs included in this report is significantly different from the rest of SMEs established in developed countries.

On the other hand, it is important to stress that the concept of adaptation can be employed in a static manner, making reference to the degree of suitability of a given technology at a certain moment in time; or to evaluate the significance of the efforts made in order to modify a technology. In this second dimension adaptation is defined as a process which involves certain activities aimed at transferring a given know how.

The following analysis deals first with one aspect of the first dimension. A second section examines the adaptation efforts made by SMEs and/or recipient firms.

#### 1. The adaptability of SMEs' technologies

Scholars that have investigated the adequacy or inadequacy of the production technologies employed in developing countries, have given particular attention to the issue of scale. In fact, for some of them (Stewart 1978, Merhav 1969) one of the main problems that poor countries face is that the production know hows imported from developed countries are not suited to their much smaller domestic markets. Typically, those technologies require for their efficient utilization the production of goods in a much larger scale than local demand can absorb. As a result, in many developing countries a low utilization of installed capacity is frequent with the corresponding effect in terms of higher unit costs of the products manufactured in them. Thus an interesting issue to analyze in this study is to what extent the inadequacy in terms of scale is also a feature of the know hows transferred by SMEs.

To carry out the referred effort, the analysis was limited only to a group of cases: those for which at least 50% of the recipient firms production was explained by products or processes manufactured with know hows supplied by the sample SMEs. Its obvious that for the other cases this analysis cannot be performed.

Interviewees from recipient firms were asked to compare the relative volumes of output of their companies with the one of their suppliers. The aim was for them to provide a gross estimate of orders of magnitude between the production outputs of both plants<sup>1</sup>. They were usually in a good position to perform this exercise since they had a good knowledge of the SMEs.

Table 24 shows that in a large number of cases the production volumes of the recipient were considered to be at least 5 times smaller than that of the supplier (including 34% in which the output differentials were estimated to be at least 10 times smaller). In only 8% of the cases for which data was gathered production volumes were considered similar among both firms.

These results put down the aprioristic notion that output differentials between SMEs suppliers and recipients would be small. In fact, these findings suggest that those differentials are in line with what is considered to be typical, at least regarding Latin American firms. At this respect Katz has indicated, that with very few exceptions, firms operating in the latter countries are "between 1-10 per cent of the size of their counterparts in developed nations" (Katz 1986).

To check the consistency of our data base, an analysis was performed as to the extent in which observed output differentials were influenced by the organizational form

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<sup>1</sup> In case the supplier had more than one plant the comparison was carried out taking into consideration the plant in which similar products as the ones manufactured by the recipient's plant were produced.

that took the venture in recipient developing countries. Table 24 classifies the recipients for which the information was available in those that were controlled totally or over 50% by the SME, those in which the SME had a minority participation and those which had signed a licensing agreements with an SME. The results indicate that those recipients which were controlled by the SME had volumes of output at least 5 times smaller than their suppliers, a proportion not different from the other two categories. This implies that the different organizational mode cannot be taken into consideration to explain the large output differentials observed in this sub-set of sample cases.

To deepen the analysis of this issue, Table 24 classifies the recipients according to their country of establishment. From it some interesting observations come out. First of all, those firms placed in Singapore, the smallest domestic market of all the six considered, had the smallest output differentials of all the 38 cases taken into account. More so, 25% of the interviewed firms in that country had similar overall output volumes than their suppliers, an outcome that in no other country could be verified. Second, although less clearcut, and with the exception of Mexico, a relationship between the size of the domestic market and the referred differentials was also detected.

These findings could be interpreted as suggesting that as has happened with the know hows transferred by large transnational corporations, the production technologies imported from the SMEs are inadequate for recipient developing countries, given the much smaller size of their domestic markets. This would imply that the know hows imported are only used partially, that is, significant idle capacity would exist among recipient firms. The fact that in the one strongly open economy in the sample output differentials were smaller would tend to support this argument.

**Table 24**  
**Size of recipient plant scale relative to SME plant scale by organizational form,**  
**recipient country and recipient's export behavior**  
 (Number of cases, in percentages)

	Output comparison				Total	Absolute figures
	More than 10 times smaller	9-5 times smaller	4-2 times smaller	Similar		
Organizational form						
Licensing agreements	56%	22%	22%	--	100%	9
Supplier minority joint venture	--	67%	33%	--	100%	6
Supplier majority joint venture	35%	43%	9%	13%	100%	23
Total	34%	42%	16%	8%	100%	
Absolute figures	13	16	6	3	38	
Recipient country						
Argentina	50%	50%	--	--	100%	4
Brazil	43%	57%	--	--	100%	7
India	25%	38%	38%	--	100%	8
Korea	--	--	100%	--	100%	1
Mexico	83%	17%	--	--	100%	6
Singapore	8%	50%	17%	25%	100%	12
Total	34%	42%	16%	8%	100%	
Absolute figures	13	16	6	3	38	
Recipient's export behavior						
No exports	42%	42%	17%	--	100%	12
Infrequent exporter	43%	43%	14%	--	100%	7
Exporter on a regular basis	31%	44%	13%	13%	100%	16
Total	37%	43%	14%	6%	100%	
Absolute figures	13	15	5	2	35	

A strong sub-utilized capacity would imply relatively high unit costs. Thus, as a consequence, a poor export performance would have been expected for those firms with large output differentials in relation to their suppliers. To test this relationship section 3 of Table 24 has been presented. Contrary to expectations, the diverse

production differentials do not appear to be crucial factors to determine a dissimilar export behavior. In fact, recipients with large differentials do export regularly only marginally less than those with a smaller output gap.

Thus we arrive at a somehow surprising conclusion. On the one hand, the large differences in volumes of output between SMEs and the recipients of their technologies suggest that the production know hows of the former can not be presumed to be a priori adequate in terms of developing country market sizes. On the other hand, and despite there huge differences, recipient firms do not seem prevented from carrying out a regular export performance. How can these two — apparently contradictory results — be sustained?

If this study would have included only recipient from countries with a highly protected (from imports) domestic market, an obvious remark would be that the referred result could be explained by the fact that those firms that exported regularly did so only in a small percentage of their total output; thus allowing them to practice a strategy of price differentiation between goods exported and goods sold in the domestic market. But the fact that this argument does not hold for Singapore in which firms have to openly compete with imports, removes this possibility.

The explanation that is put forward here is strongly anchored in the peculiarities of the modes of production being employed by the studied recipient firms. As recalled in the conclusions of the first phase of this research project, (White and Campos 1986), the crucial aspect to single out regarding scale differences was the extent of the penalty of operating below the minimum efficient point. In other words, the costs gradients that a firm faces if departing from the optimum volume of output. It will be argued here that since in custom or batch production, the penalty of operating at smaller scales is much smaller than in continuous production, recipient firms can operate at much lower volumes of output than their suppliers without losing competitiveness.

It is appropriate at this point to present Table 25. In it, the data for a group of case studies for which information was collected both from suppliers as well as recipients is shown. As it comes out, 65% of the recipient firms whose mode of production was "custom" had imported their know hows from SMEs which employed in their plant (or plants) the same mode of production. The other 35% happen to have imported their technologies from SMEs which used totally or partially a more continuous mode of manufacturing. On the other hand, in those cases in which recipients operated their plants in a "batch" or "continuous" mode, their respective suppliers employed similar production organization procedures.

**Table 25**  
**Recipient's mode of production and SME's mode of production**  
 (Number of cases, in percentages)

SME's mode of production	Recipient's mode of production			Total	Absolute figures
	Custom order	Batch	Continuous		
Custom order	65%	25%	--	47%	14
Expected demand	20%	50%	100%	40%	12
Both	15%	25%	--	13%	4
Total	100%	100%	100%	100%	
Absolute figures	20	4	6	30	

In other words, the data showed that the usual pattern was that either suppliers and their respective recipients used the same mode of production or, when this was not the case, the latter had to scale down the production process in order to perform through a "custom" mode what was manufactured in a more continuous procedure in the SME. It is interesting to point out that from the sample only one case was identified in which this result was not verified. It has to do with a Japanese subsidiary in Singapore, which produces cinematographic equipment in batches while its parent manufactures more sophisticated products for specific clients on a "custom" basis.

In conclusion, the data revealed that although recipients produced at much smaller volumes of output than their suppliers, this fact seems not to have limited the former's capacity to compete internationally. The explanation to this finding seems to have to do with the relative greater flexibility of the mode of production typically employed by SMEs so to allow for a significant reduction in output levels in the recipients without an equivalent increase in average costs. In turn, this seems plausible given that custom production is a highly skilled labor intensive mode, and that wages in recipient developing countries are lower than in SMEs home countries. In addition, most sample SMEs, engage in R&D efforts which constitute a fix cost whereas recipients competitiveness is enhanced by the fact that payments for imported technology are usually tied up to their sales value.

## 2. Adaptation efforts

The cases studied included different types of experiences regarding efforts aimed at adapting the SMEs know hows to the host country conditions. In this section product and process adaptations will be analyzed separately.

### a) Product adaptations

Supplier firms as well as recipients were asked if the products for which the technology was imported were of the same design as the ones being manufactured (at present or in the recent past) in the home country. A significant majority — of up to 70% — provided an affirmative answer.

This result is not surprising if it is recalled that the main objective of many of the transactions studied here has to do with the replication of the products manufactured

in the home countries. In other words, for many SMEs and recipients there was no intention of introducing modifications in the imported designs since they wanted to sell the respective products as equivalents of the ones produced by the SME. At the same time, the absence of an effort to modify the products may simply entail that they were a priori adaptable to the host country conditions.

Of those that gave a negative response, the overriding majority made reference as to small adaptations that were "imposed" by the circumstances of the recipient country/firm. Among them the most frequent had to do with the need to modify certain specifications of the product in order to make it more adaptable to the conditions of the host country demand. Typical of these were the modifications introduced in a light earth moving equipment by an Argentine firm which had celebrated a licensing agreement with an Italian SME according to which the product designs were imported. The changes were mainly aimed at making the equipment more robust and allowing the customer to operate it without a too close technical assistance on the part of the manufacturer.

The other frequent cause that led to the introduction of product adaptations was related to the need to take under consideration the recipient country supply conditions in relation with certain inputs or components. For example, a German manufacturer of brake and clutch-linings used in a joint-venture in India asbestos as lining material, which is quite common in this country. In Germany, on the contrary, this material can't be used since it is forbidden by law (Kumar and Steinmann 1990, see also Box F).

Of course, the nature of the manufacturing equipment used in the recipient also led to the introduction of adaptations. In this respect the usual finding was that the existence at the recipient plant of much less sophisticated equipment than at the SMEs plant, forced the introduction of some changes in the design of the product.

As a whole, the impression conveyed from the cases studied was that only minor modifications were carried out. In fact, in only a few cases of firms that produced custom-order goods, recipients indicated that they had to perform not insignificant changes in the imported designs. For the rest, as was mentioned, the usual outcome was that SMEs and recipients alike tried not to modify products in order to assure a given level of quality or the utilization of a given trade mark.

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**Box F**  
**Product Design Changes in Brazil**

[...] the availability of existing products is the main motive for product design changes. The availability may be understood both from the qualitative and the quantitative point of view.

From the qualitative point of view, all the firms in the sample had problems with the type of inputs available. In some cases those inputs did not exist in the Brazilian market. On the other hand, if they existed, they did not always have the same specifications as those originally established by the SME to produce in the country of origin. Product design had to be adapted to produce with local inputs. This process, also called "nationalization", could imply important adaptations in product design.

Thus, it was possible to observe that the changes in product design are, in a certain way, related to the market strategy of the subsidiaries, and more specifically, to the exporting activity. Therefore, when

the subsidiary was more oriented towards the local market, there were less restrictions for product design changes than when it was oriented towards the external market (otherwise it would deviate from the quality standards set by the home firm itself). The importation of critical components from the home firms was a means of the firm for minimizing the impact of the conditions of the local supply market on the product design selected to produce in the country.

From the quantitative point of view, what happens sometimes is that an input may be available in the market, but can not be purchased in volumes appropriate for a small or medium firm. This issue is related to the high concentration levels found in some sectors producing basic inputs, as for example, steel. Given these economic problems, the subsidiaries tend to modify product designs using other inputs.

A. Fleury, CEDREI-IDRC Vol.II, 1990.

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**b) Process adaptations**

A subset of recipient firms manufactured most of their products according to know hows imported from the SME. In these cases suppliers and recipients were asked as to the extent in which the process know hows used in the latter were similar to the ones employed in the former.

i) Equipment

Regarding the type of equipment used by recipient firms, two main aspects were singled out for investigation. The first one deals with the extent in which the one they employed was similar or not from the one used at the SME home country plant. The second one has to do with the national origin of the equipment used at the recipient's plant.

On 36 cases for which data was obtained, 39% replied that the recipient firm used a different equipment from the one of the SME. The usual comment that followed this answer was that recipient firms in developing countries had a much smaller output, and produced a larger variety of parts and components in-house, and for these reasons simpler, frequently universal capital goods were preferable. Some respondents also added that equipment used by the SME required a sophisticated maintenance which was not possible (or was too costly) in recipient developing countries, and that led them to choose less automated, easy to repair machinery.

Those recipients which exported regularly tended to use similar equipment than the SME, while those that did not export in more than half the cases studied declared they were employing different type of capital goods than the SME. This result is explained by the necessity on the part of the recipient firm and the SME alike, of assuring certain standards regarding product specifications when the goods were manufactured to be sold in world markets. At the same time, it is also associated with the extent of control of the SME. In fact, those recipients which had celebrated licensing agreements with the SME tended to use different equipment in a larger proportion than those that were equity controlled by the SME.

In relation with the national origin of the equipment used by the recipients, the data indicates that as a whole in 60% of the cases it was purchased mainly or

exclusively in the host country, while in the remaining 40% of the cases it was imported, mostly from the SMEs home country.

As could be expected, significant differences emerged according to the host country. As Table 26 shows, Singaporean firms imported most of their equipment requirements from the SMEs' home countries, while the opposite occurred with the other recipients (leaving the Korea one case aside). This result has to do with the existence in the latter of a developed capital goods industry with the capacity to provide equipment which suits well the recipients needs; and with the existence in them of protective measures regarding imports for those capital goods which are produced locally.

From the developed country studies carried out for this project (CEDREI-IDRC, Vol I, 1990) it emerges that cases with the participation of, say, Japanese SMEs, led to the purchase by the recipients of Japanese equipment in a somewhat higher proportion than in the other country cases. Unfortunately it is not possible from the limited evidence gathered to distinguish to what extent this is a behavior determined by the national origin of the SMEs or by other factors related with the studied cases. As Table 26 indicates, the export orientation of the recipients appears as a relatively significant variable to explain difference in equipment purchasing practices. Those firms which had a regular export behavior had imported their equipment mainly from the SME home country. Again, the desire to guarantee a given level of standardization and quality performance of the recipients manufactured products has probably influenced heavily this outcome.

Finally, the data indicates that the organizational form of the recipient has a bearing on the origin of the equipment. In fact, equity controlled ventures in 50% of the cases purchased their capital goods from the home country while the corresponding

figure for licensing agreements was 25%. This outcome suggests that SMEs rely on the source of equipment they know best.

**Table 26**  
**National origin of the purchased equipment by host country,**  
**export behavior of recipient firm and organizational form**  
 (Number of cases, in percentages)

	Origin of the equipment				Total	Absolute figures
	100% host country	Majority host country rest: SME's	Majority SME's rest: host	Another country		
Host country						
Argentina	67%	--	33%	--	100%	3
Brazil	67%	33%	--	--	100%	6
India	13%	63%	13%	13%	100%	8
Korea	--	--	100%	--	100%	1
Mexico	25%	50%	25%	--	100%	4
Singapore	--	12%	88%	--	100%	8
Export behavior of recipient						
No exports	33%	50%	17%	--	100%	12
Infrequent exporter	50%	17%	17%	17%	100%	6
Exporter in a regular basis	8%	25%	67%	--	100%	12
Organizational form						
Licensing agreements	25%	50%	25%	--	100%	8
Foreign minority J.V.	33%	33%	17%	17%	100%	6
Foreign majority J.V. and subsidiaries	25%	25%	50%	--	100%	16
Total	27%	33%	37%	3%	100%	30
Absolute figures	8	10	11	1		

## ii) Adaptations in plant designs

As was pointed out in a previous Chapter a group of cases studied included the transfer of plant designs. The sample results indicate that exactly in half of those cases the plant designs were modified, while in the other half the imported plant designs were not altered.

The analysis showed a strong association between the SMEs prevailing mode of production and their tendency to introduce modifications in the recipient plant designs. As revealed by Table 27 modifications were adopted in 71% of the cases in which the mode of production of the supplier corresponded to the category which has been labelled as "expected demand", and only in 33% of the cases the prevailing mode was the manufacturing of goods on a custom order basis.

As was referred to in the previous section of this Chapter, a significant proportion of SME, which operated according to the former mode of production had transferred their know hows to recipients which employed the latter mode. In other words, those SMEs had to adequate their respective know hows. On the contrary, all those SMEs that used a custom-order mode had transferred their know hows to firms that employed the same organizational mode.

But in addition, it is important to emphasize that the degree of technical flexibility is not similar among both modes. Production for an expected demand usually involves a certain physical lay out of the equipment, a certain method for the inflow and outflow of inputs and goods, etc. so as to optimize the economic results of the operation. It is frequently impossible to alter such equipment distribution and flow of materials without making an important technical effort or risking a high economic cost.

**Table 27**  
**Modification of the plant design by the recipient, by supplier's mode of production,**  
**Host country, export behavior of recipient firm and organizational form**  
 (Number of cases, in percentages)

	Plant Design		Total	Absolute figures
	Modified	Same		
SME's mode of production				
Custom order	33%	67%	100%	15
Expected demand	71%	29%	100%	14
Total (absolute figures)	15	14	29	
Organizational form				
Licensing agreements and foreign minority joint ventures	57%	43%	100%	23
Foreign majority Joint ventures and subsidiaries	35%	65%	100%	20
Total (absolute figures)	20	23	43	
Host country				
Brazil	67%	33%	100%	9
Mexico	63%	37%	100%	8
India	70%	30%	100%	10
Singapore	8%	92%	100%	13
Korea	33%	67%	100%	3
Total (absolute figures)	20	23	43	
Export behavior of recipient				
No exports	60%	40%	100%	5
Infrequent exporter	43%	57%	100%	7
Exporter in a regular basis	25%	75%	100%	16

In contrast, plant layouts are much more flexible and adaptable to different conditions in the case of custom order production. It comes as no surprise then, to verify that those cases of the latter type did not require particular modifications to be put forward when their respective plant designs were transplanted to recipient developing countries.

As could be expected, the higher or lower propensity to modify the plant design was associated with the organizational form of the technology transfer. Modifications were more frequent in the case of non equity controlled ventures than in those which were equity controlled. The existence of a manufacturing facility in some of the former cases and thus the need to adequate these imported know hows to the constraints imposed by that fact, were one factor that played a role. But the main explanations have to do with the nature of the host countries and the export orientation of the recipient firms.

As Table 27 shows, most projects in Singapore did not require modifications to be introduced while the opposite occurred for those ventures carried out in Brazil, India and Mexico. These results are explained in part by the need to adequate the operation of manufacturing plants in the latter countries to the restrictions imposed by the type of equipment that was installed, the characteristics of the inputs and components, the degree of vertical integration needed, etc. Typically, in those countries these conditions varied significantly from the ones that prevailed in home countries. In Singapore, in contrast, the openness of its economy allowed SMEs to transfer plant designs without the need to perform adaptations in relation with those aspects.

The export orientation of the recipient firm appeared as another important variable which explained differences regarding plant modifications. Albeit the much smaller number of observations it can be seen in Table 27 that while those modifications were introduced only in 25% of the cases of recipients which were engaged in regular exports the proportion increased up to 60% in those recipient firms that did not export.

### 3. Synthesis

Contrary to what could be expected, the differences in output volumes between the SMEs plants and the recipient firms plants that produced their goods using the former production know hows were very large. Notwithstanding, this fact did not imply that the latter firms were necessarily affected in their capacity to compete internationally. The suggested explanation has to do with the greater flexibility of production technologies controlled by SMEs, and particularly with the fact that they operated manufacturing technologies for which scale economies are relatively unimportant.

The cases studied showed that as a whole SMEs and recipient firms alike did not carry out significant efforts towards adapting the imported know hows. Plant technologies related with the manufacturing of goods for an expected demand appear to require relatively more efforts towards adapting them to the recipient country conditions, in comparison with the ones that were needed when those know hows had to do with the production of custom made products.

## CHAPTER VI

### ACQUISITION OF TECHNOLOGY BY INITIATIVE-TAKING FIRMS IN DEVELOPING COUNTRIES

#### 1. The customary view on technology transfer.

At the end of the 1960s and early 1970s concern mounted amongst developing countries due to the financial cost, and social and political implications of the acquisition of foreign technology.<sup>1</sup> From within the analytical framework prevailing at that time<sup>2</sup> a sort of stylized behavioral pattern can be recognized, according to which: a) international technology supply was considered to be dominated by mainly US-based oligopolistic transnational corporations (followed by Western European and Japanese firms) controlling their particular product/technology market segments concerned; b) technology transfer was seen as part of their broader strategies for global expansion through which they tied in high levels of sales of intermediate and capital goods for the manufacturing of particular products; and c) technology transfer

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<sup>1</sup> Thus, the issue of technology transfer was identified and discussed as a problem area in its own right. See the pioneer studies done by Cooper and Sercovich (1971), UNCTAD (1972) and Cooper (1974).

<sup>2</sup> A set of empirical studies involving several industrial branches in Argentina, Brazil, Mexico, the Andean Pact country members, Costa Rica, India, Malaysia, South Korea, Philippines and Indonesia revealed that contracts and licensing agreements between foreign suppliers and Third World recipient firms held restrictive clauses, excessive direct charges for the technology acquired in terms of payments for patents, royalties and license fees together with a great deal of transfer pricing practices. These countries case studies were conducted by the UNCTAD Technology Transfer Division and are summarized in UNCTAD (1975). Together with Vaitos (1974) study on transnational corporations and technology transactions in Latin America, they are considered the most influential in shaping the national technology policies of many Third World countries during the 1970s and part of the 1980s.

transactions were meant to almost exclusively engage transnational corporations — allegedly possessing the knowledge and the experience, and facing zero or trivial marginal costs in transferring vis a vis the costs of generating this "public good"; — with either existing sales agents, affiliates, new subsidiaries or independent licensees, seen as lacking any significant expertise both in acquiring or creating technology. In other words, the international market of technology was characterized by a very significant imbalance of bargaining power between active and dominating transnational corporations and passive and subordinated recipients.

No wonder then, most of Third World countries' policy-making efforts were aimed at imposing reductions in the level of equity in domestic firms that foreign firms were allowed to own, as well as at promoting the acquisition of technology via non-equity relationship such as licensing agreements, technical service agreements or machinery direct purchase contracts with firms. Policy strategies also included the setting up of legislation bodies to regulate all technology transfer contracts (Hoffman and Girvan 1990).

The customary view on the North-South technology transfer process has neglected the recipients' role in developing countries. Technology importers in these countries have been considered usually as passive recipients, and even when these firms were independent units they were meant to lack any significant technological capability. Therefore, technology transfer transactions were misleadingly conceived as a one-way directed flow in which the initiative, experience and knowledge were supposed to exclusively belong to the suppliers.

More recently, however, technology transfer studies have brought recipients firms' strategies and management of technology transactions much more clearly into the picture. In particular sales agents or customers have been acknowledged for their

considerable influence on SMEs' decision of moving abroad.<sup>3</sup> In a first study conducted by CEDREI, for example, results revealed that an outside proposal was the origin of the dealings in about 75% of the 32 technology transfer operations surveyed between developed country-based SMEs and metalworking firms in Argentina and Brazil.<sup>4</sup>

Even more important, however, was to learn that previously un-related domestic recipient firms actually approaching the SMEs in their own countries was the most frequently reported situation. In a number of these initiative-taking recipients, a well defined strategy of technology acquisition including the searching and selection of SMEs in the international market, the identification of their own specific needs, and the exploration and negotiation with other alternative suppliers, were detected. It was further concluded that the local recipients' active role was not only crucial for influencing the SMEs' decisions of going abroad but also for helping them in the transfer tasks, for which the SMEs were very often rather unexperienced (White and Campos 1986).

Recipient firms from other developing countries presented a similar behavioral pattern, as reported by several research studies. From a research involving 41 British firms which had transferred technology to Indian firms from mid 1970s to mid 1980s approximately, it was found that local recipients were the driving force behind the process of technology transfer to that country. It was established that in the majority

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<sup>3</sup> SMEs suppliers of parts and components for both the automotive and electronic industries "dragged out" abroad by their TNCs customers, are one of the most quoted examples of internationalization of SMEs by outside proposals (Newbould et al. 1978, UNCTAD 1982, Onida 1985, Ozawa 1985, Bertin 1986, Balcet 1984, Enos and Park 1988).

<sup>4</sup> During 1984 and 1985, direct interviews were conducted to analyze a sample of 32 technology transfer cases by SMEs from 8 developed countries to Argentine and Brazilian-based metalworking firms, mainly capital goods manufacturers (White and Campos 1986).

of the cases the technology had been pulled in by the Indian firms instead of had been pushed there by the British suppliers. The study claimed that in about two-thirds of the sample agreements the Indian firms had taken the initiative in acquiring the technology in order to meet particular problems or opportunities which it faced in the Indian market. Moreover, the survey stressed that this active behavior on the part of the local recipients did not reflect a pattern whereby the suppliers had "ventriloquized" a demand for their own technology on the part of firms in India to which they were in some way already linked. It was argued that in only about one-fifth of the sample agreements was the Indian firm already a financial affiliate of the British supplier, and in less than 10% of the cases was it the sales agent for the supplier's existing exports to India. Furthermore, by taking account of all the agreements in which the suppliers had been involved, less than half were entered into by firms with some kind of prior relationship.<sup>5</sup>

Additional evidence on the technology transaction dealings of Indian firms have reinforced these findings. Based on information on foreign collaborations officially approved between 1977 and 1983, and on questionnaires and interviews involving some 211 technology-importing Indian firms, a more recent research ratified that most of the technology transferred into this country was met through the initiative of the Indian firms. A higher level of initiativeness was also recorded as 93% of the technology agreements were said to had been initiated by local recipients (Alam 1988).

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<sup>5</sup> This is not to say that purposeful strategies on the part of the foreign suppliers had no influence at all on the technology transactions entered by the Indian recipients (Bell and Scott-Kemmis 1988).

## 2. A "non-ventriloquized" demand for technology.

This study, based on a sample of technology transfer dealings from different countries, has again found a remarkable degree of initiativeness on the part of recipients in acquiring technology. In fact, almost 90% of 52 pre-existing local recipient firms reported to have taken the initiative to search out for a possible supplier, while only 4 of them (8%) attributed the initiative to the foreign SME supplier. In the remaining 2 cases the initiative was shared between both recipient and supplier.<sup>6</sup>

Moreover, the data indicates that the active behavior of this group of initiative-taking firms was not the reflection of any sort of "ventriloquization", that is, a process by which the foreign suppliers had induced a demand for their own technology. First, prior to entering into partnership with foreign SMEs about 84% of initiative-taking local recipient firms were domestically-owned. On the other hand, the ownership pattern of the technology transactions revealed that only one of the initiative-taking pre-existing recipient firms got involved in a foreign supplier majority equity-owned venture. Conversely, about 85% of pre-existing recipient firms who actually took the initiative entered into licensing agreements with the foreign suppliers. Thus, the important point to stress is that the local initiative not only was vital to pull in the imported technology but also heavily determined the ownership pattern of the technology transactions.

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<sup>6</sup> Initiativeness was evenly distributed throughout the different recipient countries. Values for local initiative rose from 80% in South Korea to 100% in Argentina. Though Argentina, Brazil, Mexico, India and South Korea do differ in terms of their degree of industrial maturity, recent economic success and political stability, they all share a past of active import-substituting industrialization policies with tariff protection and restrictions and regulations concerning both direct foreign investment and imports of technology. In such a context, many recipients built-up significant strength and expertise to deal in technology. Furthermore, most of the few foreign initiative-driven cases were detected amongst recipient firms employing less than 100 people. Finally, local initiative prevailed in almost all different industrial branches.

Second, and more significant, almost two-thirds of this group of initiative-taking pre-existing recipient firms reported to have had no previous import or export links with the foreign supplier of technology. What's more, half of them informed to have had no previous links either commercial, personal or of other nature with the SME.

Initiative-taking pre-existing recipient firms, on the other hand, were capable enough of translating their technological needs in a demand for specific know-hows. It appeared that they had motives of their own to pull in the technology imported from abroad. They had to meet the challenges coming from specific situations and opportunities generated in the highly specialized "niches", created and controlled by them. Almost 65% of initiative-taking recipients reported to supply at least more than 30% of their respective markets, and nearly 45% of them declared to control more than 50% of total supply of their product markets.

Basically, their technology transactions were aimed at reinforcing their control of their local markets. Thus, it comes out a no surprise that in about 62% of the cases the technology they acquired was not already in operation in the local market, and was meant to allow them to secure a leading position in it. Moreover, and typically of most of the studied companies operating under the protection of high tariff barriers in oligopolistic markets, the know-hows acquired were expected to help widening the advantages they locally enjoyed based in non-price factors of competition, such as trade-marks, quality and after sale services, instead of allowing them to reduce production costs or initiate export activities. As indicated by Table 28, strengthening their domestic competitive position, diversifying their product mix, and following local customers' suggestions were the motives which most frequently led initiative-taking recipient firms to introduce the technology imported from SMEs.

**Table 28**  
**Initiative-taking recipients' reasons for introducing the technology**  
 (Number of cases, in percentages)

Reasons	Percentages	Absolute figures
Strengthening competitive position	38%	17
Diversification of product lines	33%	15
Indication from a major local customer	13%	6
Introduction of changes in the production process	2%	1
Reaction towards entry of new competitors in the local market	2%	1
Others	11%	5
Total	100%	45

"Animal export spirits" were absent in the exposed motives for locally introducing the foreign technology. Whilst a mere one-quarter of initiative-taking recipients exported on a regular basis, more than 40% of initiative-taking firms revealed to have no export activity whatsoever and other 34% of them have done it occasionally. About 70% of these 11 regular exporting companies reported an export to global sales ratio of less than 50%. Just 3 consistent exporting firms reported to have sold more than 50% of their merchandise abroad. A similar pattern was obtained as for the share of total exports represented by the products for which the technology was actually transferred.

### 3. Technological capabilities of initiative-taking recipient firms.

About 59% of initiative-taking recipient firms had accumulated a rich previous experience by prior entering either into licensing agreements, joint-ventures or both. In addition, the cases studied did not need external assistance to individualize and contact their foreign technology supplier as they appeared to perfectly know which partner they were looking for. It seems that they invested resources in learning how to identify, negotiate and acquire technology from abroad as 98% of them reported to have had

neither official nor private assistance to individualize and contact their foreign suppliers of technology.

Almost 70% of these firms knew that their SME partner held leading positions in both their market of origin and internationally for the product or technology involved. Table 29 shows that nearly half of initiative-taking recipients felt that the SME's international prestige in terms of reliability, quality and users' experience in their specific product and process technologies, led them to make their choice. Other 23% of them selected their prior foreign commercial partners as their foreign suppliers of technology. The third reason most frequently mentioned (11% of recipient firms) was that the SME offered the best dealing conditions. "Appropriateness" of the know-hows transferred, better suitability of SME products to local demand patterns, simplicity of the manufacturing process and repair tasks, lower imported inputs requirements, faster delivery of the required technology, and flexibility of transfer conditions were also reported in several cases.

**Table 29**  
**Domestic initiative-taking recipients' reasons**  
**for selecting the foreign technology supplier**  
(Number of cases, in percentages)

Reasons	Percentages	Absolute figures
SMEs' international prestige	48%	21
Previous links	23%	10
SMEs offered better dealing conditions	11%	5
Outside proposal	5%	2
SMEs were not large TNCs	5%	2
Others	9%	4
Total	100%	44

It will be argued here that recipients' initiativeness is somehow related to the technology-generating capabilities they developed, being their apprenticeship in international technology dealings a relevant part of them.<sup>7</sup> Their conscious "learning by doing" practices<sup>8</sup> might have included a sort of "learning by licensing" whereby as part of the same process of adapting, improving and generating technological skills of their own these firms ended up learning how to negotiate technology agreements in the international market.

Newly-created technology by recipient firms in developing countries has heavily drew on the need to adapt, adjust or improve a particular imported product or process, but also as a consequence of the generation of technological packages of their own<sup>9</sup>. Either by carrying out problem-solving activities — related to the scaling-down of the facilities, and the availability of inputs, parts and components, and equipment — for the operation of existing plants; or by doing trouble-shooting tasks related to the setting up of new production capacity and also brand new equipment; or by modifying product features to reflect local needs and preferences; or even by resetting input specifications to allow the utilization of domestically available endowments, several firms in

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<sup>7</sup> Evidence presented by Erber (1982), Bell and Scott-Kemmis (1988), White and Campos (1986), Alam (1988), and Ernst and O'Connor (1989) have also contributed to suggest that several recipient firms in developing countries may have generated a broader and richer capacity to search and negotiate for the imported technology than originally assumed.

<sup>8</sup> This expression goes beyond the "learning-by-doing" or "learning curve" concepts, where "learning" is a mere function of the accumulated experience in performing production overtime. "Conscious learning" includes any mean by which a firm -within a specific society and a given economic environment- purposely increases its capacity to manage technology and to implement technical change. See Bell (1984) for a meaningful discussion on the concept of "learning".

<sup>9</sup> See Katz (1987) for a thorough review of case studies on "learning" practices by developing country-based recipient firms. Strong evidence is provided to support the endogenous nature of the forces inducing the generation of new technical knowledge.

developing countries have developed the ability of assimilating and adapting foreign technologies to make them better suited to local circumstances.

All these "minor" incremental technical changes have been their answer to markets which are smaller, frequently more protected, where business concentration is much higher and the competition weaker, with more pronounced imperfections, distortions in technical information and skill shortages than those respectively prevailing in developed countries.

Undoubtedly, such profile is clearly different from the one depicted in the traditional technology transfer literature in which developing country-based firms were supposed to lack any significant expertise in creating technology and were considered as anything but passive recipients of foreign blue-prints. These "minor" idiosyncratic modifications — e.g. adaptive bottleneck-breaking and capacity-stretching efforts in existing plants, improvements in the use of by-products, life-extending adjustments for equipment, adaptations to changes in raw material sources, and alterations in the product mix — have stressed the imperfect understanding and limited imitability of technologies.<sup>10</sup>

They have also broadened the extent of the concept of technical change for developing country-based firms' "learning" practices can not be treated as a mere clones of technological search efforts undertaken by manufacturing companies in developed economies since their own technological search efforts have been very sensitive to the environment where they operated and very idiosyncratic. Even more important perhaps they have made apparent that although pieces of knowledge can be acquired from outside the firm, the ability and capabilities to make use of them have to be purposely

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<sup>10</sup> As Nelson (1979) has pointed out "...manufacturing technology is characterized by a considerable element of tacitness, difficulties in imitation and teaching, and uncertainty regarding what modifications will work and what will not".

built-in by recipient firms through the funding of indigenous technological efforts and human capital formation.<sup>11</sup>

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**Box G**  
**Responding to Import Competition in Korea**

Company C, with employment of 20 people, specializes in industrial burners. Burners are very much differentiated by their use and their fuels. Thus, each firm specializes in some segment of the market. In addition, the share of imports is high, approaching 70% of the total sales.

In addition, the domestic market is too small to achieve economies of scale. In other words, domestic manufacturers produce on an order basis while foreign manufactures produce according to the batch mode.

Company C accumulated technology by imitating foreign products. But the level of technology was not high enough to compete with imports and it lost its market share to imports, especially to high-pressure oil-burners. Thus, they seek foreign technology to strengthen their competitive position. An American company was contacted, which is a leading firm in the U.S. burners industry.

The American company wanted to have a Korean partner to compete with a Japanese firm which had

been a licensee of the firm. By having an arrangement, in some product lines the licensor can utilize the licensee as a sales agent of their many other products. Because the main motive of the licensor is to strengthen marketing channels in Korea, the royalty for the technology was kept minimal, at 1.7% of sales, without any other payment. However, exports are prohibited for 3 years following the contract. The licensor does not want to have the same experience that had with the Japanese firm.

The technology transfer involved mainly sending drawings and written technical information. Company C had the capability to understand and modify the drawings. For example, a change in the fuel tank capacity was made by the licensee without the help of the licensor. Company C was also able to apply the licensed technology to other products. Company C also acts as domestic sales agent for the licensor.

Won-Young Lee, CEDREI-IDRC, Vol.II, 1990.

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<sup>11</sup> R&D expenditure by firms in some more advanced developing countries was also related to the observed growth in their overall productivity, and to the increase in both their industrial and technology exports. Econometric testing applied by Katz (1978) to several Argentine-located industrial firms revealed that their accumulated flow of expenditure on R&D activities mostly directed to carrying out "minor" changes, was statistically significant as an explanatory variable of the observed growth in their overall productivity. Dahlman and Fonseca (1978) examining the technological history of an integrated Brazilian steel producer, have also emphasized the importance of "minor" technical changes in the observed gains in factor productivity both at the firm and industry level. Regarding the link between the growing path of some more-advanced developing countries' exports of manufactures and technology, and the accumulated flow of R&D activities directed to fund "minor" technical changes, see Katz and Ablin (1978-a) and (1978-b); and Lall (1984).

Most of initiative-taking firms studied in this research were found to have a very active technology-creating behavior. Almost three-quarters of them reported to carry out R&D activities. Also, for half of this group of firms the number of professionals involved in these tasks represented more than 4% of their global human resources. In the same vein, and also at odds with the customary view referred above, the findings of this study contribute to emphasize that these recipient firms did have to generate their own knowledge concomitantly to be able to acquire and use imported technical knowledge. In fact, despite 67% of initiative-taking firms considered the products corresponding to the technology transferred of the same design as those manufactured back in their countries of origin, about 70% of these companies actually considered they had to introduce improvements and adaptations to them. Scale problems and difficulties related to the local availability of inputs, parts and components, and equipment were the most pointed factors behind the recipient firms' efforts to make the imported technologies better suited to local circumstances<sup>12</sup>.

Domestic initiative-taking recipients also helped the rather unexperienced foreign suppliers in the actual transfer tasks. About 85% of initiative-taking recipient firms sent their local technicians to the SMEs' plants to get familiar with the acquired know-hows and to facilitate the process of technology transfer as a whole. They not only developed the ability and skills to search for and acquire imported technical knowledge but also they helped making the actual transferring tasks. Almost 60% of these firms described the role of their own technicians in the transfer process as "very significant", while other 36% considered it as "significant".

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<sup>12</sup>It is also worth underlying that although a mere 21% of foreign SMEs suppliers actually collaborated to carry out these modifications and improvements, they were considered successful by 72% of consulted SMEs to the extent that they gave their agreement to put them into practice.

#### 4. Synthesis

Up to date, and with a few exceptions, research on the North-South technology transfer process has underlined the supplier firms' active and aggressive behavior. Recipient companies' place in this process has been neglected or described as passive or merely dependent. This Chapter has shown conclusively that the referred view is undoubtedly inappropriate at least as regard the internationalization process of SMEs. In fact, the present survey has found that in a significant number of cases, SMEs' technology transfer operations have been to a large extent dependent on the experience and capabilities of domestic recipient firms.

In other words, and contrary to the usual picture on the internationalization process portrayed in most of the received literature, domestic firms in host developing countries emerged as significant actors in the transfer of know-hows by SMEs. They actually, in a large majority of ventures, contacted the SME and invited it to participate in a given deal, and contributed with their own technical skills and qualified human resources to import and assimilate the know-hows. To put it bluntly, these firms performed a vital role in the process and compensated the lack of experience and resources of SMEs to participate in the international transfer of technology to developing countries.

## CHAPTER VII

### POLICY IMPLICATIONS

The findings and lessons that come out from this study go beyond the realm of "academia". We think that a series of suggestions as to new approaches and policies regarding the international transfer of technology can be derived from the experiences analyzed. This section is devoted to a presentation of some of the referred suggestions with the expectation that the effort so far conducted can be also translated into ways and means according to which developing countries can make more efficient use of an up to now largely untapped "reservoir" of technological assets.

#### 1. The potential of SMEs' contribution

The first point to emphasize from the outset, is that this research has showed that small and medium sized firms based in developed countries are in a position of transferring their know hows to developing countries. This outcome was far from obvious when this IDRC funded project began. More so, the first reaction of some colleagues when the project was being designed was of skepticism as to the possibility of getting off ground a research endeavor which implied identifying and surveying a significant number of cases of SMEs with operations in developing countries.

As has been recalled in previous sections of this report, few studies had been made prior to the present one that have focused on nontraditional sources of technology from the view point of developing countries. The main approach to technology transfer issues is still one based on the assumption that large transnational corporations (TNC's) are the only agents really worth taking into consideration in that respect by the above

mentioned countries. In a way then, the first broad policy implication that comes out from this report, is that SMEs constitute sources of know hows which developing countries should take seriously into consideration.

Furthermore, the fact that an agent which was up to now excluded from the perceived possibilities at hand for developing countries, has demonstrated that can perform a role in the international mobilization of technical knowledge, leads to the conclusion that the international market for those assets is not so constrained as is frequently portrayed. In turn, this means that the traditional perspective according to which developing countries look at the supply market for technology, should be significantly altered in order for them to understand that they will gain much in the process if they broaden that view to include agents such as SMEs.

Putting SMEs into the picture of the international market of technology implies for developing countries adding thousands and thousands of firms to the "roster" of potential suppliers. Just to give an idea of orders of magnitude, its appropriate to recall that the total number of manufacturing SMEs in the United States approached 340.000 in 1982. The significance of this figure is better understood if one recalls that most of the literature on transnational corporations has been based on a very limited number of firms. For instance, Vernon's (1971) influential study on the subject, singled out 187 U.S. manufacturing firms as pertaining to his definition of a multinational enterprise.

It would be, of course, a gross simplification to think that taking more seriously into consideration the potential role of SMEs means visualizing their contribution in terms of substituting the one performed by large firms, and particularly, that of transnational corporations. In fact, in many situations, SMEs and large firms do not compete between them since they are established in different sectors, or the former operate as subcontractors of the latter.

## 2. "Autonomous" and recipient-country-driven SMEs

At the same time, it is important to recall — as this report has showed — that regarding the transfer of know hows to developing countries it is possible to differentiate among various types of strategies of SMEs involvement. Some of them are similar to that depicted in the literature on TNCs, while others are typical of SMEs. An important conclusion is that learning to distinguish among those categories helps to design useful policies to deal with those firms.

Some SMEs prior to their operation in developing countries could be correctly labelled "SMEs multinationals". These firms differ from typical TNCs in the absolute value of their sales, assets or employees, but operate in several countries as the latter do, have a strategy of internationalization which includes a division of labor among its different affiliates, carry on efforts of R&D at its headquarters and transmit those results to its subsidiaries according to a worldwide strategy, proceed to take the maximum possible benefit of intra-affiliate trade, etc. It was also demonstrated that some of these firms are world leaders in their product segments and are responsible of a large percentage of their total industry sales.

On the other hand, this study found that SMEs with few antecedents as regards internationalization did also participate in ventures in developing countries, but usually with the help of a preexistent recipient firm. Many of those SMEs had not a clearly defined strategy as to their international expansion and reacted to an outside proposal. Although these two ideal types clearly simplify the variegated phenomenon studied, they are a useful departing point to organize the presentation that follows.

Those SMEs with an autonomous drive towards internationalization become interested in operating in developing countries because of factors which have also been identified in studies on TNCs. It was shown, for example, that for some of them the

risks of loosing an important export market, or of establishing themselves in high growth economies, or of operating in a large close economy which cannot be supplied through exports, or of reexporting from the recipient country, etc., justify the referred involvement.

But at the same time the evidence suggests that overall macroeconomic conditions seem to be more critical at the time of an SME decision to go overseas than it is for TNCs. SMEs have, by definition, a reduced managerial staff and most decisions are taken by the owners themselves or by a couple of chief executives. The capacity of these people to understand and analyze a variety of data on various alternative markets into which to operate, is limited. Explicitly or not, countries which do not offer a reasonably stable macroeconomic environment tend to be eliminated as potential areas of investment earlier in the selection process than do those that fulfil that criteria. High inflation prone countries — like various in Latin America, for instance — are *ceteris paribus* less attractive for SMEs than others in which prices are more stable.

The same can be said with regard to the stability of the policies followed with respect to foreign investment, foreign trade regimes, capital movements, etc. No doubt, that those countries that appear in the perception of SMEs as following a more erratic behavior at this respect, will tend to be replaced earlier in the selection process. Furthermore, since SMEs control more limited resources than TNCs, the risks involved in a foreign operation are higher. It is reasonable then for those firms to minimize those risks by devoting their scarce managerial, technical as well as financial resources to projects in "safer" recipient countries.

It could be suggested then, that recipient developing countries who cannot in the short run offer a stable macroeconomic environment, should device mechanisms through which they would diminish, at least partially, the risks perceived by SMEs. One instrument is for them to sign bilateral agreements with certain developed countries

according to which they grant special treatment to small investors. This guarantee schemes if properly advertised and, if possible, backed by developed country institutions, could lead SMEs to take those markets seriously under consideration. One can envisage that the costs of these initiatives will be low given the amounts of the investments usually made by SMEs, and surpassed by the benefits of the mobilization of know-hows both for supplier as well as for recipient economies.

Another mechanism which can be used, in this case by several developed countries, is to ease the effort and reduce the perceived risk of SMEs by providing them with the financial and technical support of specialized institutions. Particularly among some European countries, certain development finance organizations exist with the aim of helping SMEs willing to operate in developing countries. There is no doubt that the latter should look for ways of benefiting from their existence, a fact which, at least from the information gathered from this survey, is not occurring.

But the impression commanded by this survey is quite pessimistic as to the influence that specific inducements can have over SMEs foreign investment decisions. Contrary to TNCs, which can take time and resources to negotiate a special deal with a host country government, SMEs are seldom in a position to afford that effort when its really necessary. At the same time, SMEs rarely can come up with a project big enough to attract the special attention of the local government and as a result, it is not so easy for them to obtain a beneficial treatment from the latter.

It is also important to recall that SMEs, including those that have already expanded internationally, usually have a more limited presence overseas than TNCs. In other words, nowadays when a typical TNC analyzes an investment in a given developing country it usually has already similar ventures in various developed and developing countries. For an SME the probability of being in a similar situation is lower. In a way then, the number of alternative markets for new operations is typically

smaller for a TNC than for an SME, and this fact also contributes for the latter to be more selective.

In addition, there is a lower ceiling for SMEs than for TNCs internationalization. The former's capabilities are, by definition, more limited than the latter's, and thus they are constrained to operate in a smaller number of foreign countries. This fact suggests, again, that developing countries interested in attracting SMEs should understand clearly that for these firms usually many other alternative markets are available, and that they are frequently not in a position to spend time and resources to alter the negative impact of the macroeconomic environment through a "package" of incentives specially designed for them.

As indicated above, the other "type" of SME studied in this report can be depicted as one which has transferred its technology at the request of a recipient firm and which has no or a very vague strategy as regards its operations in foreign markets.

On the one hand, the experience of these firms indicates that the transfer of technology overseas does not necessarily have to follow all stages of a given sequence. In fact, much of the modern thinking on the internationalization process is based on the notion that firms gradually become familiar with foreign markets first through exports, then by opening up sales agencies abroad, followed by the celebration of licensing agreements and, finally, by the establishment of production joint ventures or wholly owned subsidiaries. At the same time, this process usually is supposed to begin with operations being advanced in other developed countries and only after spilling over to developing countries.

This report has showed that many SMEs which were approached by recipient firms had no international experience prior to transferring their know hows. In other

words, firms in developing countries could obtain those resources although their suppliers had not yet carried out a complete cycle as the one depicted in what has to do with the process of internationalization.

For developing countries the first obvious implication of what has been said is that they should try to look for ways of benefitting in a systematic manner from these sources of technology. A first step at this respect is for them to have access to data banks which could provide information as to SMEs which fulfil certain criteria. It is clear, as already stated, that not all SMEs can be realistically considered to be potential suppliers. Some of them are too small or lack the minimum resources needed to participate in a foreign venture whatever the assistance they might obtain from the recipient itself or from other sources such as their home governments. Thus, an information as the one referred would be useful only if included data on SMEs which controlled those resources.

The above remark must be emphasized. In fact, as said, developing countries should take under consideration that the gap between the absolute total number of SMEs and the number of them that are in a position to transfer know hows internationally is extremely large. To single out the latter firms is the challenge that any useful data bank has to meet.

Some developed countries — such as Germany, Finland, Sweden, The Netherlands, etc. — have organizations that provide disaggregate information on SMEs to interested firms in developing countries. UNIDO has also established different offices in several developed countries with that aim. But unfortunately these institutions seemed to be rarely approached by the latter. In fact, from this survey no single case of a recipient firm that looked for a foreign technology and finally settled an agreement with an SME, declared that had used their services.

In part this result is linked with the unawareness of developing country firms on the existence of those institutions. No doubt much has to be done on the part of developed and developing countries to disseminate among recipient firms information as to the services offered by those entities and the ways of approaching them. But the impression conveyed from the evidence is that the lack of utilization of those organizations has a deeper cause: the particular features of the procedure typically employed by developing country firms to select their suppliers of technology.

It has been pointed out in this report, that developing country firms which decided to approach SMEs to acquire know hows from them, rarely undertook previously an extensive survey of potential suppliers. Some of them already were related with the SME through commercial links, and usually just went on to deepen that relationship. But in those cases in which no links existed, the selection was strongly based by the preference for SMEs of a given developed country or, at most, of a small group of developed countries.

Cultural, historical and geographical reasons are, of course, behind this trend. Rarely, in fact, a recipient firm will feel the need to go ahead with an in-depth survey of diverse suppliers in different countries, since usually it has the knowledge and sometimes some personal contacts in given developed countries. It is natural that it sticks to those countries — or regions of them — to select the supplier. Furthermore, from this survey it came out that many of the selected SMEs were world leaders in their respective industries and only when the preferred suppliers were not in a position of transferring their know hows, did recipients carry out a detailed analysis of alternatives.

### 3. The need to support recipient firms

Different implications can be derived from what has been said. On the one hand, we have learned that recipients could be helped if they could approach given institutions which could enlarge for them their horizon of potential suppliers. In other words, developing country firms interested in importing technology would gain much if they could have access to information on the configuration of the supplier market they are interested in. By this procedure, these firms would probably come to know that not always their initial preferences suit them best.

On the other hand, it is probably unwise, at least at this point, not to take seriously as an important factor that may be crucial to allow an initiative to take off, the cultural and historical features of the countries involved, and particularly of the entrepreneurs involved. In fact, it should not be forgotten, as this study has shown, that SMEs and also many potential recipients in developing countries are managed by a limited number of persons, and that a deal among these firms — be it a licensing agreement or a joint venture — will be more easily settled if a good communication and understanding is nurtured among the persons in charge of advancing the crucial decisions. It is at this light that agreements of a bilateral nature between countries with strong cultural and historical ties, aimed at promoting entrepreneurial cooperation appear as a useful initiative.

But from the point of view of developing countries, taking into account these last type of SMEs as potential suppliers of technology has other implications. It means looking at the market for know hows in a manner quite different from the one that is more frequent. More specifically, the implication for those countries has to do with a new perspective according to which, at least for a series of international transactions relating to technology, there is no sense in paying attention only to the supply side of those ventures. The characteristics and resources of the demand are as important. In

fact, this entails that a view of the market for technology which is a simple extension of the models used in economics in relation with goods or factors of production (i.e. capital and labor) is insufficient.

The important point to stress here, is that to carry out certain initiatives, the distinction between supply and demand blurred the fact that the recipients capabilities to absorb the SMEs know hows were a crucial aspect for the implementation of the project. In other words, without their active participation those ventures would not have been realized.

This view of the international transfer of technology according to which recipients are not seen as passive undertakings, nor mainly as importers but also as "active absorbers" of know hows has at least three significant consequences in terms of policies. First, and obvious, this vision, entails the need for developing countries to provide particular relevance to the building up of domestic firms capabilities, since without a minimum technical base those firms will not be in a position of seeking and assimilating foreign know hows. This report has confirmed that the familiarity with manufacturing techniques is a necessary requirement for a firm to be in a position of importing foreign know hows. Experience with at least some in-house simple R&D is also a factor identified as important.

Secondly, this vision leads to a change in the policies regarding technology imports followed by some developing countries. In fact, although clearly much less popular than in the past, still some of those countries consider that to increase the negotiating stance of recipient firms, and to reduce the costs of those imports, governments have to put their attention only in regulating the modalities assumed by those transactions. This has been, for example, the main policy implemented by India in the last decade.

As it has been pointed out by Bell and Scott-Kemmis, this policy was based on the assumption that recipients had no or very limited knowledge of what they were importing, and suppliers were particularly interested in entering through licensing a large domestic market otherwise closed for them (Bell and Scott-Kemmis 1988). The recent empirical evidence suggests that this vision does not capture many of the initiatives being advanced. More so, the impression conveyed by the referred study on India — as well as this one — is that in many instances it is the recipient firm the interested part regarding the possibility of importing a given know how and, as well, the one which is in a better negotiating position, particularly so when the supplier is an SME.

Finally, the referred vision implies that developing country governments should put into practice mechanisms through which they could effectively aid their domestic firms in the process of searching, selecting and absorbing imported know hows. In other words, as in other areas of economic policy, governments should abandon their preference — when it is still observed — for a protecting stance, as a unique mode of approaching the issue of technology imports and provide more attention to the support of those domestic firms — particularly so those of small and medium size — which are interested in importing foreign know hows.

#### 4. Mobilizing international resources

Many developing countries are going through a period of deep changes in what has to do with their economic policies. In general the new policies put forward imply, among other things, lowering import barriers and severely reducing public sector outlays. As a result of these measures, the degree of freedom to conduct industrial policies has been significantly reduced, since tariff protection has lost (or is in the process of loosing) much of its practical relevance, and governments are in no position

of providing incentives to given manufacturing sectors or individual investment projects (usually established in certain backward regions).

It would be suggested here, that an intelligent use of the existent sources of technology in the world and particularly of SMEs, is an instrument to fulfil some — but obviously not all — of the objectives traditionally aimed at by industrial policies in developing countries. More specifically, there is ground to suggest that — with the interested help of developed countries — the former could design channels and fora through which domestic firms can select and meet entrepreneurs from SMEs in order to implement projects between them. These projects will help upgrade the skills of recipient firms, increase their competitiveness and, given the large export propensity of some SMEs as those included in this study, contribute to allow them to reach foreign markets with their products.

Developing countries should design special campaigns to attract SMEs to their markets. These promotional efforts should be specially tailored for each developed country and, particularly, for each given industrial sector taking into consideration that usually the more salient potential suppliers have a significant participation in their domestic markets. These initiatives have to reach the entrepreneurs directly and the host country should be "advertised" in a simple and reliable way. Again, to be effective, these initiatives should be based on a deep knowledge of the peculiarities and changes that are going on in given industrial branches of certain developed countries, in order to present the advantages of the potential recipient country in relation with them.

On the part of developing countries, several beneficial features of SMEs as suppliers of technology can be singled out. From the fact that because of their size they rarely become involved in difficult or conflicting situations vis a vis host governments, their more flexible stance relative to TNC's with respect to the control of a venture in a host country, their possession of know hows such as those related with the production

of custom order goods which would not be easily obtained otherwise, etc. But in terms of this Chapter's purpose, it is particularly appropriate to underline the finding from the survey according to which most SMEs had a high export propensity. This entails that, contrary to well diffused preconceptions, SMEs are in a position of contributing to transfer the capabilities needed by recipients to export. At a time of severe balance of payment restrictions, this possibility appears as particularly attractive for most developing countries.

Anyhow, it is important to underline in dealing with this subject, that SMEs should not be seen always as the better option as suppliers of technology. In fact, in some industrial branches SMEs do control know hows that a priori are not appropriate for developing country conditions. Thus, the advantages, as well as the drawbacks of these firms should be analyzed in each case. Furthermore, it would be sad if developing countries would begin to confer to SMEs all sort of positive attributes which are not empirically justified. A naive view according to which "small is — always — beautiful" in the terrain of international technology transfer, would do developing countries a great disservice.

At a more concrete level of analysis, it should be recalled that usually smaller firms, in contrast to large firms, face more difficulties in mobilizing financial resources for investing in projects overseas. On the one hand, because normally they appear as less credit-worthy than TNCs from the point of view of banking institutions. On the other, because usually an investment overseas — particularly the establishment of a production facility — implies a much larger relative effort (in terms of its overall assets) for an SME than for a TNC.

Obviously, this constraint that SMEs usually experience, is particularly sensitive nowadays for many developing countries which are going through severe balance of payments restrictions. The fact that in many instances, projects in developing countries

with SMEs participation require a domestic capital contribution is a feature which makes those firms less attractive than larger firms, which are in a position of performing the direct investments by themselves.

Some developed countries have created financial institutions with the aim of supporting their home country SMEs in their overseas operations. They participate as a minority shareholder in the recipient firm and in this way they help the SME (as well as their developing country partners) to raise additional financial resources from the capital markets. Also, when needed, they provide guarantees through which those firms can obtain loans from commercial banks. There is no doubt that every effort that developed countries could put forward regarding an increase in the capitalization of those entities would be very helpful for the internationalization of SMEs, and of course for recipient developing countries.

The referred field is one in which international or regional public investment banks such as the World Bank, the Interamerican Development Bank, The African Development Bank, etc., could play a role directly or — probably more appropriate — through their affiliates which deal specifically with the financing of the private sector. This possibility would be clearly in the interest of developed and developing countries alike.

## 5. Overcoming SMEs' limitations

Small and medium sized firms from developed countries operate in a tight industrial network. This means that in terms of a standard input-output table, most of the cells in those countries are occupied. In other words, a given firm can rely strongly on the market since most of its requirements regarding specific parts or components can

be purchased through it. If needed, subcontractors can also be approached to handle the manufacturing of those goods which cannot be bought directly, from the "shelf".

When it comes to operate in a developing country, usually some of the required inputs cannot be obtained so easily. Frequently they are not produced locally, and importing them is not always a feasible alternative. As a result, to carry out a project in a developing country, an SME faces severe obstacles which are not easily solved. In contrast with TNCs which if necessary are in a position to modify the industrial environment in which their affiliates operate, SMEs have not the resources nor the political or economic influence to put into practice a similar behavior. In other words, these firms are much more dependent on the overall industrial development of the host country.

The referred conclusion is relevant since it points to a very important limitation of SMEs. In particular — and the empirical evidence supports this statement — those firms normally encounter serious obstacles to operate in countries with a very weak industrial sector. Thus, as a whole, these firms do not appear as easily available potential suppliers of technology, in the short and medium run, for the least developing countries.

From scant evidence derived from the case study and information obtained from some developed country organizations devoted to the promotion of developing country operations of SMEs, it appears that these firms experience more frequently than TNCs changes in their positions in their home country markets. As a result, when this occurs, these firms tend to reduce their commitments in their foreign ventures. It is interesting to stress that those referred changes are not necessarily caused by a bad performance. On the contrary, given SMEs limited financial and managerial resources, it is not rare to verify that when a growth opportunity emerges at home these firms are not always capable of maintaining their presence overseas. Of course, this is a more probable

outcome in cases in which SMEs participate as minority shareholders in a joint venture, or as licensors.

Most small and medium sized firms from developed countries have not participated in ventures abroad. Operations of this type are viewed as intrinsically risky for them. It is safe to say anyhow, that once SMEs go ahead with such projects, the experience gained makes them much more inclined to participate in other similar initiatives. Particularly if from them they are in a position of increasing their technological competence — for example, through learning from the recipient experience in using its know hows — as well as deriving income (from royalties, etc.) which would not have been possible otherwise. In other words, internationalization can be viewed also as a learning process.

From this perspective, the first project overseas carried out by an SME will necessarily imply larger relative costs than the ones that follow. From a social benefit point of view then, it seems reasonable to suggest that developed and developing countries would gain if some mechanisms were devised to put down the private costs of the first international involvements of SMEs. In this vein, focused "advertising" campaigns as the ones that were mentioned above could well be tackled by both types of countries with the help of some international organizations: other actions, related in this case with the transfer of technology as such, can also be implemented.

SMEs technological capabilities should not be equated with SMEs technology transfer capabilities. The control of know hows does not assure a similar capacity to transmit them overseas, particularly to firms in developing countries. Given their usual lack of experience regarding international production operations, SMEs tend to have weak transfer capabilities. Engineering and consulting firms appear as useful agents that can help SMEs overcome these constraints. But again, the evidence from this survey suggests that very rarely have these firms hired their services. It is clear that much has

to be done to convince potential supplier firms of the need to benefit from the advice of specialized undertakings. Governmental efforts through which both types of firms may obtain the needed technical support at a reduced price may lead manufacturing firms to decide to approach those entities.

In order to participate in a foreign production venture, SMEs need to perform a series of operations aimed at formalizing their know hows, together with dispatching to the host country technicians familiar with them, and/or being in a position of receiving recipient firm's personnel to deliver to them the relevant skills. Carrying out these tasks usually entails not insignificant costs for those firms, particularly when they have to face their first technology transfer experience. For this reason, ways of easing those efforts should be advanced by governments of home and host countries. There are probably at least two concrete mechanisms which could be used at this respect. The first one has to do with the assistance of certain technical organizations from industrialized countries to help formalize the know hows controlled by SMEs. The second one, deals with the need to reduce the costs associated with the training of personnel and the dispatching (either way) of engineers and technicians through the utilization for that purpose of the resources that are controlled by national and/or international organizations devoted to the diffusion of technical knowledge.

# ANNEX

## MAIN PRODUCT LINES OF SAMPLE SMEs

Country	SIC	Product	Firm size
Italy	2211	Wool weaves	205
Germany	2821	Foundry auxiliary resins	430
U.S.A.	2821	Electrical isolating resins	460
U.S.A.	2831	Biotech. (vaccines)	200
U.S.A.	2831	Biotech. (vaccines)	350
France	2834	Skin treatment cosmetics	460
Italy	2834	Pharmaceutical raw materials	78
Canada	2891	Additives for concrete	8
U.K.	2891	Sealants and adhesives	390
Germany	2899	Chemical auxiliaries	470
Italy	2899	Chemicals for textile industry	54
Japan	2899	Stablizer for PVC	110
U.S.A.	2899	Hydraulic fluids	340
U.S.A.	2899	Microorganism control chemicals	440
Italy	3021	Rubber soles	240
Canada	3079	Synthetic steel strapping	50
Germany	3079	Household cleaning plastic product	80
Italy	3079	Plastic recipients	200
U.K.	3079	Baby feeding bottles	500
U.S.A.	3079	Recipient fastners	350
Germany	3261	Sanitaryware in ceramics	60
U.K.	3264	Porcelain electric insulators	450
Canada	3411	Oil containment equipment	24
Canada	3441	Transmission line towers	200
Canada	3441	Transmission line towers	270
France	3441	Heat exchangers	500
U.S.A.	3441	Heat exchangers	300
Italy	3442	Aluminium door accessories	180
Japan	3452	Screws	320
Japan	3493	Spring fastners	500
Germany	3494	Valves for ships	154
Germany	3499	Knitting & crocheting needles	300
U.S.A.	3499	Expansion joints	250

Country	SIC	Product	Firm size
Italy	3531	Construction machinery	150
Canada	3532	Equipment for mining & construct	75
Canada	3532	Rock drilling equip. & tructs	500
France	3532	Mining and forestry equipment	130
Germany	3532	Mining machinery	400
Canada	3549	Electronic assembly soldering	250
Canada	3549	Equipment for electrical wires	100
France	3549	Welding guns	230
Germany	3549	Pins & piercing punches	145
Germany	3549	Special purpose machines	270
Italy	3549	Metalworking machinery	350
Japan	3549	Grinding machines	500
U.S.A.	3549	Surface treatment machinery	150
Italy	3551	Coffee machines	500
U.K.	3552	Cotton carding machines	460
Canada	3559	Capsule manufacture plants	100
Canada	3559	Explosion supression systems	6
Canada	3559	Ion exchange equipment	115
Canada	3559	Metal refining equipment	300
Canada	3559	Oil & gas process equipment	55
Canada	3559	Oilfield equipment	35
Canada	3559	Tyre retrading machines	55
France	3559	Special shock absorbers	330
Germany	3559	Machine tools for circuit boards	135
Italy	3559	Ceramic ind. prosses	200
Italy	3559	Packaging machines	180
Italy	3559	Plants for chemical industries	500
Italy	3559	Rubber industry machinery	100
U.K.	3559	Pulverizers	24
Germany	3561	Pumps	430
Canada	3563	High pressure air compressors	7
Canada	3567	Industrial furnaces	45
Germany	3567	Industrial furnaces	400
Italy	3567	Industrial furnaces	350
U.S.A.	3567	Industrial furnaces	150
U.S.A.	3567	Mining & petrochemical equipment	500
U.S.A.	3567	Oil burners & furnaces	175

Country	SIC	Product	Firm size
U.K.	3569	Cranes	115
U.K.	3569	Material handling equipment	50
Canada	3573	Electronic equipment for computers	85
Canada	3573	Video display terminals	364
Canada	3573	Videotext, teletext, videodisc	29
U.S.A.	3573	Computers	250
Canada	3585	Refrigeration equipment	150
U.S.A.	3585	Refrigeration equipment	300
Canada	3612	Electrical distrib. equipment	500
Italy	3612	Electrical distrib. equipment	80
U.K.	3612	Electric power generators	401
Italy	3613	Electrical switches	15
U.K.	3629	Industrial batteries	300
Italy	3631	Household cooking equipment	500
Canada	3643	Copper foil for printed circuits	12
France	3648	Lighting equipment accessories	360
Canada	3662	Radio telephone equipment	340
Canada	3662	Telecommunication systems	250
Japan	3679	Switches & keyboards	350
U.S.A.	3679	Rectifiers & printed circuits	40
Germany	3699	Resistors	77
Canada	3714	Radiators	14
France	3714	Pumps for automobiles	150
U.K.	3714	Gear boxes	200
U.K.	3714	Metal car components	400
U.K.	3714	Thermostats for motor cars	80
Japan	3743	Electric equipment for railroads	400
U.K.	3811	Non destructive testing equipment	21
Italy	3824	Fluid meters	75
U.K.	3824	Meters for liquids	90
France	3829	Temperature and pressure sensors	80
U.K.	3829	Switches & pressure indicators	120
U.S.A.	3829	Measuring instruments	350
U.S.A.	3829	RFI control instruments	120
Japan	3832	Special cinematography products	170
U.S.A.	3832	Infrared viewers, optical devices	25

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