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# FROM INFANT INDUSTRY TO TECHNOLOGY EXPORTS: THE ARGENTINE EXPERIENCE IN THE INTERNATIONAL SALE OF INDUSTRIAL PLANTS AND ENGINEERING WORKS

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# I. INTRODUCTION

Argentina - like most semi-industrialized countries - has not so far been regarded as a potential exporter of technology. On the contrary, practically all the studies available on this subject examine its role as an importer of technological knowledge generated in relatively more developed societies. However, there is evidence that in the last few years both Argentina and other "late industrializers" (for example, Mexico and Brazil on the Latin American scene) have had some experiences as exporters of technology, which may be interpreted as clear hints of a more significant trend.

Since the sixties, manufacturing exports - some showing a fair degree of sophistication - have begun to make up a significant and growing proportion of the flow of foreign trade in these countries 1/. More recently still, it is possible to detect the appearance of exports of technology, whether it appears explicitly as such, or is incorporated into industrial investment "packages" or others for the provision of services with an implicit technological content

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1/ The continuity of the manufacturing export process - regardless of the effect of short term factors connected with the promotion of this kind of export - can be observed in the following series of figures, which show the share of industrial exports in total Argentine exports.

Argentine Exports 1969-1976 (in millions of US$)

| Year | Industrial Manufactures (1) | Total Exports (2) | (1)/(2) 100 |
|---|---|---|---|
| 1969 | 166 | 1 611 | 10.30 |
| 1970 | 191 | 1 772 | 10.78 |
| 1971 | 211 | 1 740 | 12.13 |
| 1972 | 278 | 1 941 | 14.32 |
| 1973 | 596 | 3 265 | 18.25 |
| 1974 | 836 | 3 929 | 21.28 |
| 1975 | 628 | 2 961 | 21.21 |
| 1976 | 794 | 3 916 | 20.28 |

Source: Secretaría de Estado de Comercio Exterior

(sanitary projects, transportation, etc.)

The aim of this monograph is to analyze some aspects of recent Argentine experience in this area.

The concept of technology exports covers a vast range of international transactions ranging from the mere granting of a license, or the right to use a patent, to the sale of a complete industrial plant with its basic engineering, blue prints, setting up and operating manuals and know-how, management rules, personnel training etc. Within these broad limits, the sale may involve different combinations of the technology and knowledge units concerned, the specific package depending on the kind of supplier and customer involved, and on each particular set of negotiations.

Of this wide range of tradeable techonological assets, we shall only deal here with cases involving the sale of complete industrial plants, and engineering works for the provision of services (warehousing, hospitals, airports, etc.) in which technology is part of a more general "package" including provision of equipment, transfer of usage rights for patents, etc.

The granting of licenses, direct technical advice, consulting services, etc.- considered per se, and independently of the provision of tangible assets - are not the subject of this paper. This decision was taken, not because these kinds of technological exports are unimportant in the case in question. On the contrary, we consider that they constitute a different facet of a single process and evidence of their existence provides further support for the thesis which we shall here uphold. However, a fundamental reason has led us to limit the coverage of our analysis and exclude such examples from this research. This is the great difficulty in obtaining quantitative information regarding exports of "disembodied" technology, since, although the evidence indicates that they do exist 2/, there is no systematic register listing them,

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2/ The export of consulting services by groups of Argentine professionals has been a common occurrence during the last few years. There have been experiences dating from the mid-sixties. However, it is practically impossible to gather information regarding these transactions, since there has been no obligation to register them, nor have they been encouraged by any measure which help to identify them indirectly. The lack of private incentives for the export of services has resulted in most transac-

and it is reasonable to consider that in most cases they are carried out through informal channels.

The export of complete plants, or "turnkey" contracts latu sensu are, in our opinion, significant examples of the process of industrial maturation which has been developing in the Argentine manufacturing sector. At the international level it would appear that this maturation process is making itself apparent in two relatively new developments: the first is a grwoing export capacity in more sophisticated manufactured goods, while the second, which appears to be connected to what has just been discussed, is reflected in the first signs of the export of "embodied" and "disembodied" technology. The latter is a new development which, in our opinion, is likely to gather strength during the coming decades, and therefore requires urgent consideration.

The hypothesis that learning in the industrial sector could give rise to a sequence of exports of ever increasing technical sophistication - the fundamental argument of this paper - has its origin in an earlier piece of research 3/ in which the authors analyzed the relationship between technological change and export capacity. In fact, in that paper we suggested the hypothesis that variables of a technological nature (those representing learning processes and domestic research and development activities) play a dynamic role in the external competitive capacity of the manufacturing sector of countries like Argentina, Brazil or Mexico. In this way, these variables contribute to shifts in the pattern of dynamic comparative advantages with which these countries operate on the international scene 4/.

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tions being carried out without the intervention of banks or customs authorities, and they do not in fact appear in the country's external accounts. This situation increases the difficulty of gathering information at the firms' level, since the latter are reluctant to discuss the subject.

3/ Jorge Katz and Eduardo Ablin, Tecnología y exportaciones industriales: un análisis microeconómico de la experiencia argentina reciente, Desarrollo Económico, Nº 65, April-June 1977, IDES, Buenos Aires.

4/ The influence of domestic technological development on the flow of international trade will depend - obviously - on the technological evolution of the same industrial sectors in the more advanced countries, and therefore on the possibility of reducing the productivity gap in specific branches of industry. The

The observations gathered during this research have given rise to the central hypothesis which we examine in this paper. We assert here that during the last decade, and as a consequence of a significant process of technological learning, various industrial sectors have been improving, and adapting to local conditions, technologies initially acquired from overseas. Successive adaptations, additions and improvements introduced have led to the likely development of a new technological asset, different from the one employed several years previously, and with its own tradeable value. The process we attempt to describe, in which Argentina is beginning to participate as a supplier in a market for complete plants, would thus reflect the first experiences of the sale of such technological assets.

The point of view we have sketched out above undermines some current conceptions in the debate on international technological trade, such as the sharp distinction between countries which generate technology and those which are recipients, and thus demands more research which would throw light on this new dimension of the technological phenomenon. Likewise, the hypothesis set out here forces a reconsideration of some points concerning the characteristics of the import substitution process in countries like Argentina. Almost a decade ago Hirschman 5/ put forward the sequential nature of industrialization based on import substitution. Our approach again takes up this concept of sequence in the industrial process. We believe that the export of manufactured goods as an expression of productive maturity is also subject to a cycle of

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protectionist attitude of some advanced countries with regard to industries they have been unable to modernize during the last ten years (the most eloquent example being the textile industry), would seem to be an indicator that the phenomenon pointed out here might be occurring.

5/ On this point, we suggest consulting A. Hirschman, "The Political Economy of Import-Substituting Industrialization in Latin America", The Quarterly Journal of Economics, Feb. 1968, pp.2-32. In this article Hirschman holds that in countries which are late-late industrializers, "... industrialization via import substitution becomes a highly sequential or tightly staged affair. Herein lies perhaps its principal difference from industrialization in the advanced countries. This aspect is so familiar and seemingly inevitable that it has not received quite the attention it deserves"

increasing complexity, which eventually leads to the export of technology, and to its by-products, such as the sale of complete plants or to direct investment in manufacturing 6/. The evidence gathered during our analysis of the Argentine industrial exports spectrum shows that there has been intensive learning, which seems to be a repetition of the process observed in the developed countries during their initial decades of industrialization, but which must be viewed in the light of smaller and structurally weaker market possibilities.

It is very likely that the process we have described could also be present in other geographical contexts (Australia, countries in South East Asia or Eastern Europe). Our attention is drawn - naturally- to the Latin American context, where the boom in this kind of sales among the countries in the area is patently clear. In this respect, Mexico 7/

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6/ This topic, closely connected in our country with the export of technology, should be the subject of a wider debate, which has already begun in the Argentine context. An example of the awareness of this new phenomenon is the creation of an Office for Overseas Investment (Dirección de Inversiones en el Exterior) by the Economy Ministry (see La Nación, 1/11/77). At the academic level there are a few introductory monographs which should be followed up. See Louis Wells, The Internationalization of Firms from the Developing Countries, Graduate School of Business Administration, Harvard University, January 1976.

7/ As an example of what happens in the countries mentioned we can quote some general information. Thus, in the Mexican case, between January 1973 and July 1975 exports of technology and special services reached a value of US$ 137 million, a figure which can be considered promising given the incipient nature of the process and the strong growth of this type of export since the last date mentioned. In fact, if we bear in mind that the plant sold to Argentina in 1976 for the production of newsprint from sugar cane bagasse in the Province of Tucumán alone involves a project costing US$ 200 million, one can have some idea of the dimension of what is happening in this direction. Mexico has successfully approached the sale of plants through -among others- four basic technologies developed locally: i) H and L's (Hojalata y Lámina) technology for direct reduction in the iron and steel industry. The Venezuelan firm of SIDOR has set up its Orinoco steelworks using this system, which is also incorporated - or about to

Brazil 8/ and Argentina stand out.

In this monograph a certain sample of cases which reflect the Argentine experience in this area is examined. On the basis of this information, we attempt to make a preliminary approach to a subject which in our opinion requires both further investigation, and a different conception from the point of viw of economic policy than that which it receives at the moment.

The Second Section presents the empirical evidence gathered during this research. In it we examine the forms in which the technology is sold, the characteristics of the firms involved in this kind of exports, the markets supplied, etc. Besides the statistical material, the second section provides a brief description of some of the cases included in the sample studied.

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be incorporated - in the iron and steel industries of Brazil, Irak, Indonesia and Zambia. ii) DEMEX technology developed by Petróleos Mexicanos (PEMEX) for metal extraction from crude oil during refining (used in Colombia and Jamaica), and a refining system which will be marketed by UOP Inc., one of the largest consulting firms in the petrochemical area. iii) The Cortina method, conceived by I.C. Construcciones for premoulding concrete structures, already used in Colombia and Venezuela. iv) The Cusi process - belonging to Bufete Industrial - for the manufacture of newsprint from sugar cane bagasse.

8/ In the hope that Brazilian exports of services will increase rapidly, the President of the Bank of Brazil revealed that bid bond transactions grew from US$ 2.2 million in 1974 to US$ 38.3 million in the first nine months of 1976. Likewise, performance bond transactions, which did not exist in 1974, rose to US$ 2.7 million between January and September 1976. On the other hand, the measures undertaken by CACEX to promote the sale of engineering studies and projects overseas include credits for US$ 75 million to finance the construction of airports in Bolivia, sanitation works and pipelines in Paraguay, a hotel in Peru, and communications between Brazil, Bolivia and Peru, as well as the exploitation of water resources in Senegal.

The foregoing is the translation of a statement made by Angelo Calmon de Sá, President of the Bank of Brazil, during a Services Export Seminar held in the auditorium of the Itamaraty and published in the Jornal do Brasil on 22nd October, 1976.

The Third Section presents a set of considerations related to the "explanation" of the phenomenon observed. It is obvious that at the moment we lack a built-up theory which would allow us to throw light on it. Neither development theory, nor the recent evolution of the theory of international trade in terms of the "product cycle" or of the "neo-technology-theory of trade" 9/, consider the possibility of some "late industrializers" entering the world technology market as suppliers of complete plants and/or various technological services. The lack of a formal theory does not, however, imply that we underestimate the problem's significance; hence our interest in opening up a discussion which we consider of great current importance.

The Fourth Section examines briefly the legal instruments connected with this kind of exports. Important conceptual changes can be observed in the regulations in force in Argentina in recent years. Likewise, these differ considerably from those current in other Latin American countries prominent in this field, typically Brazil. These topics are studied in the fourth section.

Finally, the Fifth and last part of the paper contains a brief summary of the results achieved and suggests possible items for study in this field in the near future.

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9/ In this respect see: G.C.Hufbauer, The impact of national characteristics and technology on the commodity composition of trade in manufactured goods. In (Ed.) R. Vernon: The Technology Factor in International Trade. NBER., Columbia University Press, 1970.

## II. THE ARGENTINE EXPERIENCE IN THE EXPORT OF INDUSTRIAL PLANTS AND ENGINEERING WORKS: CHARACTERISTICS OF THE PARTICIPANT FIRMS AND THE TECHNOLOGY INVOLVED

### 1. The Empirical Evidence

In this section we present the empirical evidence available regarding exports of complete industrial plants as well as the construction of engineering works. To do this a list of examples has been compiled and analuzed; these we examine below after clarification of some methodological points concerning the type of data available and the way in which they have been processed. First of all, no claim is made that the material presented constitutes a sample in the statistical sense, since the firms included have not been drawn from a wider universe by the use of selective techniques. More precisely, the examples presented in Table 1 themselves form the universe known to the authors at the time of writing, although the Argentine industrial sector's experience as an exporter of technology is certainly much wider than that contained in the table 10/.

Secondly, it is necessary to point out the great difficulty involved in measuring the phenomenon being examined, since there are no statistical sources which systematically compile the data concerned. In fact, with the exception of the register set up in the Secretaría de Estado de Comercio Exterior y Negociaciones Económicas Internacionales (State Secretariat for Foreign Trade and International Economic Negotiations) for the purpose of administering the rebate instituted by Decree Nº 2786/75 (which we shall refer to later), there are no specific forms on which these exports must be registered, nor is there an ad hoc tariff position in the Export Nomenclature for recording the outgoing goods which form part of a turnkey transaction. Consequently, the examples listed here had to be identified by means of indirect information. We have chiefly

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10/ Various cases have been left out because of lack of knowledge of the amounts involved in the transaction, while others have been so at the explicit request of the participant firms; likewise, several of the firms listed in Table 1 have carried out other transactions of this kind, but only those cases for which most information was obtained have been selected.

Table 1. Complete or Turnkey Plants and Engineering Works Exported by Argentina during the Period 1973-1977

| | Firm | | Destination | Year | Value in US$ |
|---|---|---|---|---|---|
| 1. | De Smet Arg. S.A. | Vegetable oil factory | Bolivia | 1973 | 5,524,873 |
| 2. | Nisalco S.A. | Plant for production of cooked meat and meat extract | Brazil | 1973 | 200,000 |
| 3. | Standard Electric Arg.S.A. | Automatic Telephone exchange and external communications plant | Ecuador | 1973 | 678,857 |
| 4. | Sicom S.A. | Thorough communications system for public service | Chile | 1973 | 2,829,396 |
| 5. | SEI Ingeniería S.A. | Meat combine. Complete slaughterhouse and meat-packing plant for beef | Cuba | 1974 | 12,500,000 |
| 6. | Phoenicia S.A. | Complete bakery plant | Cuba | 1974 | 2,900,000 |
| 7. | Nisalco S.A. | Glycerine production plant | Mexico | 1974 | 90,000 |
| 8. | Emepa S.A. | 15 storage sheds with metal structures and facings for port storage | Cuba | 1974 | 6,775,007 |
| 9. | Emepa S.A. | Sheds with metal structures and decks and silos for poultry farms | Cuba | 1974 | 15,940,532 |
| 10. | Talleres Adabor S.A. | Metal silos With integrated transporters | Cuba | 1974 | 2,829,073 |
| 11. | Lix Klett S.A. | Air conditioning, ventilation and heating installation for a bank building | Paraguay | 1974 | 90,000 |
| 12. | Meitar Aparatos S.A. | Citrus fruit processing | Cuba | 1975 | 6,200,000 |
| 13. | Dosicenter S.A. | Two plants for honey production | Cuba | 1975 | 1,490,000 |
| 14. | Eximparg S.A. | Plant for extraction of vegetable oil from cotton seed | Bolivia | 1975 | 4,000,000 |
| 15. | S.A. Lito Gonella e Hijo | Supply, distribution and pumping terminals for liquid gas | Ecuador | 1975 | 1,998,300 |
| 16. | Techint S.A. | Oil pipeline and pumping stations | Peru | 1975 | 120,000,000 |
| 17. | Laboratorios Bagó S.A. | Antibiotic production plant | Bolivia | 1975 | 220,000 |
| 18. | Benito Roggio e Hijos S.A. | Turnkey airport | Paraguay | 1975 | 52,000,000 |
| 19. | Nisalco S.A. | Water treatment plant for industrial use | Uruguay | 1975 | 47,300 |
| 20. | Meitar Aparatos S.A. | Processing of citrus fruits, pineapple and mandioca | Bolivia | 1976 | 8,810,000 |
| 21. | Establecimientos Gele Electromecánica S.R.L. | Plant for spice processing and packing | Cuba | 1976 | 1,441,000 |
| 22. | De Smet Arg. S.A. | Complete plant for oil extraction via solvents and pellet plant for the processing of sun-flower & soya cakes | Uruguay | 1976 | 746,376 |
| 23. | Harial S.A. | Plant for production of lead oxide | Venezuela | 1976 | 146,800 |
| 24. | Harial S.A. | Plant for lead smelting and recovering | Venezuela | 1976 | 105,700 |
| 25. | Cemati S.A. | Manufacture of forge spare-parts for electric plants | Bolivia | 1976 | 146,466 |
| 26. | Phoenicia S.A. | Complete bakery plant | Chile | 1976 | 114.971 |
| 27. | Industrias Metalúrgicas Caissutti S.A. | Poultry slaughtering and processing plant | Paraguay | 1976 | 186,671 |
| 28. | Giuliani Hnos. S.A. | Balanced powdered food factory | Bolivia | 1976 | 239,173 |
| 29. | Gases Industriales S.A. | Fats refining plant | Chile | 1976 | 286,256 |
| 30. | Secadoras Iradi S.A. | Grain processing and storage plant | Uruguay | 1976 | 483,572 |
| 31. | Laboratorios Bagó S.A. | Plant for extraction of active elements from vegetables | Honduras | 1976 | 450,000 |
| 32. | SEI Ingeniería S.A. | Plant for manufacture of sodium caseinato and/or calcium and powdered buttermilk | Uruguay | 1977 | 269,654 |
| 33. | Tecnimontsade (Consorcio Italo-Argentino) | Plant for pesticide manufacture | Bolivia | 1977 | 45,000,000 |
| 34. | Latinoconsult S.A. | Turnkey hospital | Ivory Coast | 1977 | 46,000,000 |
| | | TOTAL | | | 343,742,179 |

Source: Prepared by the authors with original information.

used files and fragmentary information from the Administración Nacional de Aduanas (National Customs Administration) as well as making direct visits to firms conected with this kind of international activity.

A reading of Table 1 raises several topics. In the first place, it is necessary to analyze the heterogeneous nature of the transactions identified. In fact, different cases were observed of the export of: a) Industrial plants; b) Public service units; c) Agricultural construction and equipment; d) Construction and equipping of various civil enginering works, etc.

These differences in the nature of the transactions identified bring out a second element connected with the span of contracts. In this respect the enormous spread in the range of values of the different contracts stands out very clearly as they appear to fall into two quite distinct categories, both because of the amounts involved and the kind of works concerned.

Bearing in mind the previous comments, the mean and standard deviation of 3 different aggregates were calculated: a) those corresponding to the total of the contracts studied; b) the same, excluding the Techint contract, in view of its obvious distance from the mean value of the sample, and c) those of the total, excluding the 6 largest contracts, the individual figures of which exceed 10 million dollars.

Table 2: Average Value of Sale of Plants and Complete Works in the Contracts Examined

| Nº of Contracts | Arithmetic Mean | Standard Deviation |
|---|---|---|
| Total of 34 contracts | US$ 10,021,829 | 23,315,961 |
| 33 contracts (excluding the Techint contract for US$120 million) | 6,689,157 | 13,717,960 |
| 28 contracts (excluding the 6 over US$10 million) | 1,760,773 | 2,405,680 |

Source: Drawn up by the authors from original data.

The following table shows the distribution by value of the contracts studied, further dividing each group into two categories: industrial plants and engineering works.

Table 2 undoubtedly reflects the enormous spread in the values

Table 3: Distribution of the Contracts Studied by Value Sections and Type of Export

| Amount of the Contract | Industrial Plants | Engineering Works | Total Contracts |
|---|---|---|---|
| - less than US$ 100 thousand | 2 | 1 | 3 |
| - between US$ 100 thousand and US$ 1 million | 12 | 2 | 14 |
| - between US$ 1 million and US$ 10 million | 7 | 4 | 11 |
| - between US$ 10 million and US$ 100 million | 2 | 3 | 5 |
| - over US$ 100 million | - | 1 | 1 |
| | 23 | 11 | 34 |

Source: Drawn up by authors from original data.

of the contracts 11/. Note that by simply excluding the Techint transaction for the purpose of calculating the arithmetic mean, the average level is reduced from US$ 10 to US$ 6.6 million. On the other hand, the engineering works (mainly those for the provision of public services) are chiefly found in the groups of over US$ 10 million per contract. The high unitary value of these works means that they represent 73% of the value of the export universe we are studying, even though numerically they barely make up half the number of transactions involving industrial plants.

The distribution referred to previously offers a preliminary idea about the nature of the industrial plants exported, vis-à-vis the engineering works, indicating that the plants set up to supply limited markets of the type found in Latin America are by nature of a smaller scale than the structure works carried out in the same markets. If it is borne in mind that the competitivity of exports of plants by Argentina - as will be seen later on - is

11/ At this stage the distortion introduced by the Techint contract in the sample data must be considered for further reading of the subsequent tables. In fact, it is the only case over US$ 100 million, a record local figure for this kind of exports. Therefore it makes up a substantial proportion of the total of the transactions registered, and its exclusion forces us to correct all the percentage calculations. For that reason, from now on, the reader must bear in mind the effect on the tabulated values of the exclusion of this contract from the calculation, so that there are now only 33 observations in the list.

connected with industries showing slight concentration and which have been successful largely on the basis of the adaptation of productive processes to more limited scales, the significance of the data we have presented can be easily guessed.

We shall return to this point when the technological characteristics of the plants exported, of the participant firms, and the geographical destination of the sales are analyzed.

The next topic to be considered in our analysis is the development of this new kind of transaction in the Argentina export context. It is appropriate to point out that prior to 1973 Argentina firms had already occasionally exported complete or turnkey works and plants - and even technical advisory services and "disembodied" technology - 12/. However, such transactions did not show any continuity, but rather represented isolated facts which to some extent heralded the flow of exports which motivated this paper. It is for this reason that, even though there are a few cases of exports prior to 1973, we decided to restrict our empirical information to the period after that date, as is shown in Table 4. 13/

The following table shows the annual development of the foreign trade flow in industrial plants and works, which indicates an upward

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12/ Exports prior to 1973 have rather been connected with technical advice provided by Argentine professional groups. As an example we can mention Latinoconsult S.A., which has participated as a consulting firm in agricultural projects in Central America since the mid-sixties.

13/ It must be emphasised that in Table 4 the contracts are grouped according to the year in which they were drawn up. This must be borne in mind, since most of the projects in question take some time to be carried out - that is, that they last more than a year from start to finish, and occasionally some time goes by between the signing of the contract and work being started.- Therefore, the dates of settlement for each transaction vary, depending on the source of information. Bearing in mind that the date of signature of the contract has been chosen as the year of export of the respective plant or work, it must be remembered that many of the projects listed have not yet been completed, and most of those corresponding to 1977 have not even begun. The criterion adopted is undoubtedly arbitrary.

Table 4. Complete Plants and Works Exported Annually Period 1973-1977

| Year | Nº of Contracts Signed | Total Value in US$ | Average Value per Contract in US$ | Annual Percentage Over the Period 1973-1977 |
|---|---|---|---|---|
| 1973 | 4 | 9,233,128 | 2,308,282 | 2.7 |
| 1974 | 7 | 41,124,612 | 5,874,945 | 12.1 |
| 1975 | 8 | 185,955,600 | 23,244,450 | 54.6 |
| 1976 | 12 | 13,158,985 | 1,096,582 | 3.8 |
| 1977* | 3 | 91,269,854 | 30,423,285 | 26.8 |
| | | 340,742,179 | | 100.0 |

* First six months

Source: Drawn up by authors from original data.

trend over the period under consideration, with the exception of the fall registered in 1976. 14/ However, we understand that the importance of the annual development of this kind of exports must be regarded in relative terms, given the method of assigning them to a particular year, when the transaction actually stretches over a more or less extended period. 15/ Therefore, the development of this kind of exports should be viewed in the context of a series which would merely indicate the trend of this phenomenon.

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14/ It is noticeable that the 1973-75 exports follow a clearly rising trend, even if the Techint contract, which corresponds to the last year of the period, is removed. Moreover, the figures registered in 1977 also exceed the amount for 1975 excluding that transaction, which means that, quite apart from the distortion that contract introduces, it is clear that exports move upwards, with the exception of 1976. The average values per contract seem to move in the same direction.

15/ This situation would be modified if we had a long range series, but such does not exist - obviously - because of the incipient nature of the phenomenon.

Let us now look at the factors relating to the nature and origin of the firms which participate in this export flow. Foreign trade in manufactured products from developing countries like Argentina has repeatedly shown its protagonists to be the subsidiaries of multinational firms established in them 16/. In the case of the export of industrial plants and complete works, even when these subsidiaries play a significant role, the pattern of distribution of the transactions arranged shows that domestic firms predominate.

Table 5. Number of Exporting Firms and Agreed Transactions

| Origin of Firms | Number of Firms | Number of Contracts | Total Value in US$ | Average Value per Contract | Percentage of Total Exported |
|---|---|---|---|---|---|
| Domestic Capital | 20 | 28 | 168,505,817 | 6,018,065 | 49.45% |
| Multinational Subsidiaries | 5 | 6 | 172,236,362 | 28,706,060 | 50.55 |
| | | 34 | 340,742,179 | | 100.00 |

Source: Drawn up by authors.

Hence, as the above table shows, the subsidiaries of multinational corporations which participate in the universe of our analysis are four times less in number than the domestic firms, and represent only a fifth of the total number of contracts studied. Nevertheless, the average value of the transactions they have carried out is almost five times higher than that of those relating to domestic firms (twice if we exclude Techint). The difference in average values we have indicated means that even with a smaller number of contracts these subsidiaries practically equal the total percentage of exports of local firms, which is reflected in the last column of Table 5.

Table 6 gives us the complete list of multinational corporations which have exported industrial plants or complete works from Argentina.

16/ See Jorge Katz and Eduardo Ablin, op.cit.

Table 6. Share of Subsidiaries of Multinational Corporations in the Export of Plants or Works

| Firm | Nº of Contracts | Value in US$ | Percentage of Total Exported |
|---|---|---|---|
| 1. De Smet Arg. S.A. | 2 | 6.271.249 | 1.84 |
| 2. Standard Electric Arg. | 1 | 678.857 | 0.2 |
| 3. Techint S.A. | 1 | 120.000.000 | 35.22 |
| 4. Gases Industriales S.A. | 1 | 286.256 | 0.08 |
| 5. Tecnimontsade S.A. | 1 | 45.000.000 | 13.21 |
| | | 172.236.362 | 50.55 |

Source: Drawn up by authors.

The breakdown to the firm level in Table 6 enables us to see the full extent of the bias caused by the Techint contract in the sample. The exercise of excluding the latter from the universe analyzed results in a drop in the share of the subsidiaries of multinational corporations in the export of plants or complete works to only 23.6% of the total. Likewise, the average value per contract for this category of firms would be US$ 13 million, a figure which would still be double the average of the transactions undertaken by domestic firms. In other words, over and above the distortion caused by the scale of the transaction referred to, the sales carried out by multinational corporations are on a bigger scale than those made by local firms.

Two final factors to be analyzed are the sectors of economic activity to which the exports of industrial plants or complete works belong, and the geographical destination of these items.

Regarding the first factor, it must be pointed out that the classification by activity of the exports studied here has presented some difficulties. It is clear that there could be more than one criterion for placing the transactions in one or other sector, depending on whether they are viewed from the standpoint of the main productive activity of the supplier firm, or on the

basis of the purpose of the product in question - that is from the point of view of demand - .

Therefore an industrial classification of the United Nations C.I.I.U. type would present some problems for the purpose of our study:

i) many of the plants or works might be included in sections with very broad features as in the case of "contructions".

ii) the "turnkey" concept covers precisely a group of activities which are spread throughout the classification and which in this case it is not appropriate to break up.

iii) the difficulties mentioned render this kind of classification of little use for the purpose of identifying which are the specific sectors in which the experiences of overseas sales under the "turnkey" heading could show certain comparative advantages.

Bearing the foregoing in mind, a sui generis classification from the point of view of demand was chosen, which would accurately reflect the purpose of the goods acquired in the place where they are located and built. On this basis, Table 7 was drawn up, in which an additional column was included showing in brackets the numbers corresponding to each contract listed in Table 1. This enables easy identification of the cases which have been grouped in each demand sector of the chosen classification.

It is appropriate to make some further qualifications concerning the criteria adopted for the classification. In the first place it must be remembered that the allocation of a complete sale to a specific demand sector omits any consideration of the nature of the inputs involved in such a transaction on an individual basis. In this way, a plant for processing citric fruits will be included in the food industry item even though the greater part of its components may be equipment from the metallurgical or metalworking sector. On the basis of the same criterion the construction of storage sheds for port service comes under the heading of constructions even if they are made of metal. In the second place, and as a result of the classification which has been adopted, no close correlation should be expected between the importance of particular industrial sectors and their capacity to export complete plants. This is so since, while the size of a branch of industry is measured by the value of its production, exports are classified by sectors of final demand. For this reason, branches of industry of very large absolute size, but whose goods are inputs for other final industries, do not figure as

Table 7. Exports of Plants and Works Classified by Demand Sectors

| User Sector | Contracts in Table 1 included under this item | Total Number of Contracts | Total Value | Average Value per Contract | % of Total Exports |
|---|---|---|---|---|---|
| 1. Food Industry | (1)(2)(5)(6) (12)(13)(14) (20)(21)(22) (26)(27)(28) (29)(32) | 15 | 44,911,174 | 2,994,078 | 13.18% |
| 2. Chemical Industry | (7)(17)(19) (31)(33) | 5 | 45,807,300 | 9,161,460 | 13.44 |
| 3. Metal Industries | (23)(24)(25) | 3 | 398,966 | 132,988 | 0.12 |
| 4. Oil | (15)(16) | 2 | 121,998,300 | 60,999,150 | 35.80 |
| 5. Construction including agricultural and warehouse | (8)(9)(10) (11)(30) | 5 | 26,118,184 | 5,223,636 | 7.67 |
| 6. Transport | (18) | 1 | 52,000,000 | | 15.26 |
| 7. Communications | (3)(4) | 2 | 3,508,255 | 1,754,127 | 1.03 |
| 8. Sanitation services | (34) | 1 | 46,000,000 | | 13.50 |
| | | 34 | 340,742,179 | | 100.00 |

Source: Drawn up by authors

significant exporters of complete plants as such, but would be concealed in other sectors responsible for carry out the transactions. 17/

Table 7 attempts to weight each demand sector in the group of exports studied by measuring two parameters: the number of contracts per area, and the percentage of total value they represent.

The limitations of the universe analyzed which have already been mentioned (distortion produced by the size of the Techint contract, etc.) leave some doubts about the validity of these indicators in all cases, which does not, however prevent some conclusions of a general nature from being drawn. Thus, for example, it is difficult to specify exactly the importance of particular demand sectors - like Transport, Health Services, and to a great extent Oil - in which only one contract has been discovered in each case. These transactions were far bigger than the sample average and make up two thirds of the universe analyzed, but we do not have a sufficiently representative number of contracts to be able to assess their potential. On the other hand, the food and chemical industries stand out clearly as the most important areas in this experience, both because of the number of contracts they cover and because of the percentage shares arising from the latter.

The construction industry is a separate case, which - as has already been explained - has to be broken down to avoid the effects of its too comprehensive characteristics. Nevertheless, the limited interpretation applied to the concept of construction (including agricultural and warehousing) includes 5 contracts which amount to almost 8% of the total sample, which gives some measure of the significance of complete non-industrial works within the overall phenomenon.

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17/ This line of thought could provide an explanation for the minute share of the metal industries sector in the sample analyzed, although the possibility of an underestimation arising from statistical factors already pointed out should not be discounted. A comparison of the percentage exports of each sector in the sample with their respective share in the Argentine industrial GNP showed that only in the case of Food and Beverages did the rates have any relation.

With reference to the geographical destination of exports of plants and engineering works, in practice they have been restricted to the Latin American area. In fact, 86.5% of the whole of the sample included in Table 1 involves this region, with a marked bias towards neighbouring countries, which cover 35.6% of the total values. 18/ The only exception in this respect is the recent sale to the Ivory Coast (Africa) of a complete hospital, a contract belonging to the "turnkey"category. 19/

These points arise from Table 8, which presents exports by country of destination according to the number of contracts signed in each case.

Table 8 shows a wide spread in the share of the twelve countries registered as destinations of the exports we are concerned with here. This is largely due to the very range of values of the contracts which make up the universe analyzed, a subject which we have already referred to. In fact, it is difficult to establish any kind of connection between number of transactions in a country and its significance as destination of overall sales, since in se-

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18/ Regarding the geographical concentration of sales of this kind in areas of influence - usually border areas - it is appropriate to point out that in the first stage of Japan's expansion in the area of technology exports, there was also an emphasis on South East Asia, that is, neighbouring countries. Even nowadays 33% of Japanese transactions in the chemical sphere take place in Asia. As an example of this point, see the article by Masaaki Aoki: Why Japan Trades in Technology, Hidrocarbon Processing, March 1977.

19/ An initial analysis of Argentina's commercial relations with Africa would doubtless show a very significant lag in comparison with Brazil. The latter is apparently managing to solve successfully communications and transport problems, etc., and has made the African continent an explicit objective in its export expansion policy. Argentina, on the other hand, has had no clear policy towards this area, which in this case could be a reflection of a wider context of international relations. A specific example is that Argentina has not yet become a member of the African Development Fund, an institution which finances important infrastructure works and which, because of its charter, is only able to contract with firms from countries which are members of the Fund. This situation was experienced on several occasions by the firm which has now obtained the transaction in Abidjan, and which had been disqualified before in connection with other projects for the reasons mentioned.

veral cases there is a single contract which weighs heavily in the sample and therefore distorts it (for example, Peru and the Ivory Coast). However, it can be observed that the first five countries in the list cover 25 of the 34 transactions studied, which

Table 8. Exports of Plants and Works by Country of Destination

| Country | Nº of Contracts | Total Value in US$ | Average Value per Contract | Percentage of Total Exports |
|---|---|---|---|---|
| 1. Cuba | 8 | 50,075,612 | 6,259,452 | 14.70 |
| 2. Bolivia | 7 | 63,940,512 | 9,134,358 | 18.77 |
| 3. Uruguay | 4 | 1,547,102 | 386,775 | 0.45 |
| 4. Paraguay | 3 | 52,278,671 | 17,426,223 | 15.33 |
| 5. Chile | 3 | 3,230,625 | 1,076,875 | 0.95 |
| 6. Ecuador | 2 | 2,677,157 | 1,338,578 | 0.79 |
| 7. Venezuela | 2 | 252,500 | 126,250 | 0.07 |
| 8. Peru | 1 | 120,000,000 | | 35.22 |
| 9. Brazil | 1 | 200,000 | | 0.06 |
| 10. Mexico | 1 | 90,000 | | 0.03 |
| 11. Honduras | 1 | 450,000 | | 0.13 |
| 12. Ivory Coast | 1 | 46,000.000 | | 13.50 |
| | | 340,742,179 | | 100.00 |

Source: Drawn up by authors.

amount to 50% of the value of the sample. Moreover, if the effect of the Peruvian pipeline is removed for the purpose of the calculation, this ratio rises to 77%.

From its commencement in 1973, the phenomenon of the export of complete industrial and turnkey plants by Argentina has been associated locally with the economic links with Cuba established

through the bilateral agreements undertaken by this country in that period. The fact that these agreements have provided the framework for a large part of Argentina's experience in the subject, has led to the belief that Cuba has been the main market for Argentina turnkey transactions. A reading of Table 8 throws some light on this a priori idea, since it can be seen that Bolivia has practically the same number of contracts as Cuba, and exceeds them in value. From this it follows that Bolivia has so far been Argentina's main market in this new kind of export.

This point does not mean that the role played by Cuba in stimulating this kind of exports should be underestimated but rather puts it into perspective within the overall picture, since it is obvious from the empirical evidence that the phenomenon is not restricted to the "Cuban case", but is more far-reaching.

Apart from the preliminary statistical analysis of the previous pages we consider it appropriate to describe below some individual cases which will help the reader to understand the circumstances surrounding the phenomenon under analysis.

## 2. Some Examples

Let us now look at some examples which illustrate the kind of situations involved in the statistical material presented.

I. Gael S.A. is a domestic firm which produces equipment for processing fats and oils for the food industry. Although its members have a long professional experience in the sector, the firm was set up less than a decade ago. It originated because of the realization by one of its members - an oil processor - that there was an opportunity to manufacture and sell equipment for the sector; he then decided to join the engineering group which up to then had provided his plant with technical advice. Until well into the sixties, the oil processing equipment used in our industry was imported. In 1970 Gael began to design its own machines and to provide technical services to third parties. Subsequently, the firm developed the remaining technology for the construction, assembly, putting into operation and personnel training, and managed to sell 10 complete plants in the home market before envisaging its first "turnkey" experience in Bolivia. At present, the firm holds 40% of the domestic equipment market.

The firm has very favourable conditions in the international market, since it does not have to compete with large corporations. The countries with most experience in the sector are Belgium,

Italy and the United States, but with the exception of a division of Krupp, all the firms are of medium size. With regard to prices the firm has usually operated at levels as much as 40% lower than some of its competitors, which is indicative of the competitive capacity which can be achieved in sectors with slight concentration at the international level and in which a certain degree of price competition prevails.

The problem of plant scale does notseem to have great significance for this firm. Gael S.A. has sold plants ranging from 1 ton/day to 600 tons/day in the local market. The average capacity of the plants contracted internationally with European firms amounts to 150 tons/day, while the current contract with Santa Cruz de la Sierra (Bolivia) involves production of 200 tons/day. It can thus be observed that the firm has experience in the sale of plants ranging from those which could be considered to be of "pilot" scale to those which exceed the average size of international designs. This flexibility, in the firm's opinion, is directly associated with the technical and engineering versatility of its staff.

II. A second interesting example is SEI Ingeniería S.A. Again this is a business group set up during the sixties, one of whose branches succeeded in developing locally industrial processes in the chemical area which - even if not new internationally - were restricted to large scale production by firms like Monsanto, Duperial, Cía Química, etc. Several processes, such as stearification, and the production of plastifiers and stabilizers for the plastics industry etc. were developed, among others, requiring in all cases a markedly lower investment than that of any of the abovementioned. Nowadays, Vinisa (the SEI Ingeniería plant which operates in this field) covers 60% of the local market, follow by the firms which until a few years ago were the traditional producers.

The firm began its expansion into the Latin American market with an initial sale to Uruguay of a "turnkey" plant for the production of plastifiers and compounds, wich because of its size would have been a pilot plant by the standards of any developed country.

During this transaction the firm found that the problem of scale was not a determining factor in an industry whose main cost is incurred by raw materials. Subsequently, parallel production lines for several other plastic compounds were added to the Uruguayan plant on the basis of the same original investment, and this has become the country's most important firm in the sector.

Another aspect which SEI paid attention to was the adaptation of known technology to the use of local inputs. Thus, one of the plastifiers manufactured - epoxide oil - used to be obtained according to practices then current from soya, a crop not widely produced in Argentina in those days. The firm adapted the process for the use of sunflower oil, widely grown in the Argentina rural sector. The experience accumulated in the course of this adaptation enabled it later on to undertake a new process using fish oil, which proved of interest to a Peruvian firm.

Once Vinisa S.A. had completed the plastic development stage, the SEI group took on its present form by incorporating new members also recruited from the academic area, who had experience in the evaporation and dessication of primary products. From here on they went into the production of equipment for the food industry, mainly intended for the processing of powdered milk, blood and tomato, instant coffee, etc. Their greatest success was in the dairy products industry where they entered into price competition with traditional firms in the local market. Once the sale of equipment became consolidated, they began to offer complete plants to the domestic market, and the first exports to Latin America took place. SEI realized that their international competitors in the milk industry (Niro, Alfa Laval) provided equipment only as separate items, so it decided to export complete plants which would enable it to compensate for the prestige and international brand it lacked.

Thus, it exported several milk plants and, taking advantage of learning externalities in the food area, it branched out into the design and sale of complete plants in other areas such as the meatpacking and cold storage industry.

III. A third example which deserves mention is Argental S.A. (it exports through Phoenicia S.A., and international trading firm). This firm began as a bakery. In the course of production, it found solutions to various technical problems which affected its performance, such as those connected with the moisture level, and its relation to the climate, drying, air currents in oven design, recycling of the previous day's surplus stock, etc.

In the course of these typical "trouble-shooting" activities, it designed special equipment for the sector, which became well known in the domestic market and was even exported on several occasions. With some international experience, the firm embarked on the project of exporting complete bakery plants under the "turnkey" formula, an outstanding instance being its contract with Cuba.

The authorities there were interested in providing French-type

bread, which was not produced on the island. On the occasion of the Argentine-Cuban Economic Cooperation Agreement, they indicated their intention to Argental S.A., but on condition that it would be a central plant for the whole of Havana with a capacity of 50 tons of French bread per day.

The order had no precedent of such dimensions, since there was no previous experience in the world of production of French bread on that seale. It must be remembered that the supply of this kind of good in the countries where it is consumed is fragmented into a infinite number of individual firms, usually run by their owners. In this case, the Cuban stipulations required that an original technological solution be found.

Argental S.A. had to redesign all the engineering it had developed for plants of average size, and just as adapting technology to reduced scales involves serious difficulties (since it is not a matter of dividing all the relevant parameters proportionally to the size of the new plant) the opposite process - increasing the scale - meant that many functions had to be recalculated. This transaction is the clearest example of the flexibility with which the technical and engineering staff approach the adaptation and improvement of known techniques, since it is a task in which medium-sized firms seem to have a wide experience.

We here conclude our examination of the empirical evidence available concerning the export of complete industrial plants and engineering works.

The material presented - although still rudimentary - suggests among other things the following: a) We are probably witnessing a phenomenon due to increase over time; b) Both domestic firms and local subsidiaries of multinational groups are involved; c) A high proportion of the contracts registered belong to sub-areas of the Food and Beverages sector and the Chemical sector; d) The phenomenon goes beyond the "Cuban case", there being a high proportion of contracts with Bolivia and Uruguay; e) In several of the cases studied there are clear signs of international competitiveness, which is expressed through the winning of contracts in open bids, or in situations in which more than one alternative proposal has been assessed.

The next section sets out some considerations towards an explanation of the facts observed.

## III. "ADAPTIVE" INNOVATION AND EXPORT CAPACITY. A SERIES OF CONSIDERATIONS

### "Late Industrializers" and "Minor" Inventive Activity.

The rate of technological change in a particular country is associated both with imports of foreign technology and domestic technological generation. Perhaps one of the most substantial differences between mature industrial countries and "late industrializers" must be sought in the relative weight of these two paths, since by all accounts it is obvious that in the latter kind of countries the flow of foreign technology definitely predominates over domestic R & D as a source of the technological change which has been observed.

The foregoing should not, however, be interpreted (although it frequently has been) as an indication that countries like Argentina, Brazil or Mexico lack a flow of domestic technological generation. On the contrary, empirical observation indicates that this is not strictly so, and that the flow of local R & D can hardly be considered non-existent. It is evident that in semi-industrialized countries imported technology - whether "embodied" or "disembodied" - plays a leading role in the overall economic system, but it does not necessarily follow that these countries completely lack an internal flow of R & D. Neither can it be assumed that technology acquired abroad is employed without further ado, that is, without requiring adaptive technological efforts to allow it to function efficiently in different operating conditions from those for which it was conceived. 20/

The key problem for elucidating this matter lies in the question as to what type of "technological generation" is being considered. If inventive activity is thought of as consisting exclusively of technological efforts associated with the development of major changes in the state of the art, it is reasonable to deny the existence of such efforts in the kind of countries we are dealing with. If, on the other hand, we accept the available empirical evidence, it suggests that in these countries there is a significant domestic R & D effort of a "minor" kind, directed rather at improving imported technological designs and/or

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20/ Jorge Katz: Importación de tecnología, aprendizaje e industrialización dependiente, Fondo de Cultura Económica, Mexico, 1976.

adapting them to local conditions, than to generating mayor "leaps forward" in the frontier of knowledge. Therefore, rather than denying the phenomenon, it seems appropriate to accept the fact that there is a flow of local technological generation, but of a different kind from that which occurs in the more developed countries.

This process of innovation which has been referred to, which could be called "minor inventive activity", has important connotations, both micro- and macro-economic, for semi-industrialized countries. It will be of particular interest to study below the relation between this phenomenon and export capacity.

## "Minor" Inventive Activity and Dynamic Comparative Advantages

Of the several consequences arising from the existence of a flow of "minor" inventive activity - or from sub-innovations- developed independently at plant level, two are of special importance from the point of view of their effect on export capacity.

The first one is connected with the aggregate impact of these "minor" technological efforts on the overall productivity of the factors employed by the firm undertakes them. The second consequence arises in part from the foregoing and refers to the effect of the increase in productivity on the relative gap between a specific plant and the "average pattern" prevailing on the international scene in a particular field of manufacturing production. We shall argue here that productivity increase and adaptive technological change are necessary (though certainly not sufficient) elements to bring a particular firm closer to competitive standards, thus making possible its eventual participation in the Latin American and/or world market for manufactured goods.

Let us look at the two topics separately. Various studies carried out in recent years confirm the paramount importance of "minor" technological change as source of substantial increases in manufacturing productivity. Perhaps the most detailed of these papers is that is that by S. Hollander, who, after studying several rayon producing plants belonging to the Du Pont corporation in the United States, concludes with the statement that: "... the contribution of "minor" technical change to increased efficiency over time, has been of great importance in the case analyzed. The contribution of minor technical change as a proportion of the contribution of both "minor" and "major" technical change amounted to

100% at Spruance II, 83% at Spruance II-A, 80% at Spruance I, 79% at Old Hickory, and 46% at Spruance III". 21/

Other authors, perhaps in less detailed studies than those by Hollander, essentially confirm the same picture. Among them the papers by N. Terleckij 22/, J.Enos 23/, J.Minasian 24/, Z. Griliches 25/, etc. stand out. In connection with the Argentine industrial environment, the research carried out by J. Sábato et. al. 26/, A. Petrecolla 27/, J. Katz 28/ and others shows that the flow of domestic technological efforts, mainly of minor nature, also has a very significant effect on industrial productivity in countries which are "late industrializers".

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21/ S. Hollander, The Sources of Efficiency Growth, MIT University Press, 1966, Chapter IV, p.120.

22/ N. Terleckij, The Sources of Productivity Advance. A Pilot Study of Manufacturing Industries, unpublished doctoral Thesis, Columbia University, 1960. (Microfilm version, Ann Arbor, Mich., 1970).

23/ J.Enos, "Invention and Innovation in the Petroleum refining Industry", in: (ed.R.Nelson), The Rate and Direction of Inventive Activity, NBER, pp.299 ff., Princeton, 1962.

24/ J. Minasian, "The Economics of Research and Development", in: (Ed.R.Nelson), The Rate and Development of Inventive Activity, NBER, p.93, Princeton, 1962.

25/ Z. Griliches, Commentary on the paper by W.F.Mueller, "The Origins of the Basic Inventions Underlying Du Pont's Mayor Product and Process Innovations, 1920-50", in: (Ed.R.Nelson), op.cit., p.323.

26/ J.Sábato, R.Carranza and G.Gargiulo, Ensayo de régimen de tecnología. El caso de la fundición ferrosa, mimeo, Buenos Aires, 1974.

27/ A. Petrecolla, R. Zubieta, H. Abrales and J. Nogués, Industrial electrónica y progreso técnico en un contexto de industrialización, Editorial del Instituto, Instituto Di Tella, Buenos Aires, 1974.

28/ J. Katz, op. cit., Fondo de Cultura Económica, Mexico, 1976.

Now, what relation -if any- is there between this productivity increase as well as adaptive technological change, and export capacity?

In order to answer this question it is necessary to observe that domestic technological efforts carried out by birms operating with an imported technological design are often the result of the need to adapt these designs to local operating conditions. This need to adapt may be connected with: a) the type, cost, etc. of raw materials available on the domestic market 29/; b) relative price of factors in that market; c)the scale of installed plant; d) climatic, geographic, etc. conditions in which the product and/or process involved are used locally 30/; e) particular characteristics and demands of the local consumer with regards to quality, service, etc. 31/; f) type of by-products and waste from the manufactured product or the process employed; g) differences in the legal and institutional framework, in the labor

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29/ It is rather common, for example in the petrochemical area, to find firms which at the time they initiated local operations employed imported raw materials which subsequently - due to supply problems, foreign trade crises and the impossibility of importing, prices, etc.-were replaced by local quasi-substitutes (never exactly alike). This substitution usually required a detailed applied research effort, as well as experiments in pilot plants, etc.

30/ The automotive industry, tractor production, etc., are typical cases in which the country's physical structure - as well as the nature of local rural activity (extensive plains with little rough terrain) - have led most industrial establishments operating domestically to introduce significant modifications and adaptations to designs originaly from the United States or Europe. See in this connection the cases of Ford and Fiat referred to in a previous paper, J. Katz and E. Ablin, op. cit., Desarrollo Económico, Nº 65, Vol. 17, 1977.

31/ The electronic products consumer industry is often quoted as an example of a sector in which the domestic consumer does not request the same level of sophistication as is probably found in mature industrialized countries. Domestic technological efforts often result in the "de-sophistication" of foreign technological designs.

field or in the structure of the local market 32/, etc.

Once the various kinds of inadequacies of the imported technological design have been solved - through "minor" innovations developed locally - it is intuitively clear that the available technological package ("blue-prints", engineering rules, etc.) must necessarily be different from the one initially acquired abroad. Whether in embodied form (in the final product, in the machinery used in its production, etc.) or in disembodied form (in terms of engineering procedures, management rules, etc.), the "new" technological package must possess a higher degree of adaptation to local conditions than the original technological design. 33/

In these circumstances it is hardly surprising that the "new" technological package is well received in third markets characterised by a geography, climate, institutional background, size, type and price of economic factors as well as available raw materials, etc., and other features to some extent similar to the local ones which gave rise to the need for adaptive technological efforts.

In other words, in such circumstances it is hardly surprising that the adaptive technological efforts give rise to the eventual appearance of a "new" technology able to earn profits by itself in third markets 34/.

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32/ A recently completed study on the rate of technological change in the Ducilo Argentina rayon plant reveals the fact that labor legislation in this country in several areas (e.g.: sanitary conditions, environmental questions, etc.) is even stricter than that current in the United States. This means that the firm's engineering team had to carry out R & D work locally in order to comply with requirements which the original technology never had to face.

33/ In other words, the "new" technological package is a production function more "appropriate" to local conditions.

34/ To be strictly true, this "new" technology can also earn additional profits in its own market of origin, either by expanding its proprietor's volume of production ( which would allow it to capture a larger share of total demand) or through licensing to third producers. There are, however, reasons for thinking that such courses of action will not normally be chosen by the owner of a technological package of the kind examined here.

This may occur through various mechanisms; for example: 1. the direct export of products involving "embodied" technology; 2. programs of direct investment; 3. licensing to third firms; 4. the sale of a complete plant, etc. Let us examine these alternative options.

## Product Export, Licensing, or Complete Plant Sales?

Several Argentine firms with international experience in export transactions involving complete industrial plants began by exporting finished products which had their technology embodied.

What is the reason for their aiming later on at the sale of a technological "package" involving the transfer of their own technology?

In order to answer that question, it seems advantageous to bear in mind that what happened in many of these cases does not substantially differ from what other authors have found in various studies in recent years which have attempted to throw light on the origin of direct foreign investment by large multinational firms. 35/

The export of finished products has a ceiling that is reached as recipient countries put import substitution policies into operation. These policies almost always involve the imposition of tariffs to enable the establishment of local production plants for which the internal market is then reserved. In such circumstances, the firms which up till then based their penetration strategy on

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On the one hand, it is unlikely that the owner of a "new" technology will be interested in licensing it to another firm operating in the same market. On the other, and because of the very nature of the technological knowledge involved in the "new" technological package - which does not go far beyond the prevailing state of the art, but rather consists of "minor innovations" relatively accessible to firms already competing in the innovator's market of origin - its resale value will presumably be lower than that which they may perhaps obtain in third markets.

35/ See, for example, R. Vernon: Sovereignty at Bay. The Multinational Spread of US Enterprises; Basic Books, New York, 1971.

direct placement of their products are forced to abandon this line of action and seek new ways of access to the market. At this point, two possible alternatives are available: a. to sell know-how to a local capitalist or b. to settle in the country through direct investment (either by association in a "joint venture" agreement with other firms or not).

There is no one pattern of reaction to this dilemma within the sample studied here. The larger firms, which have greater international negotiating capacity, seem to have chosen to operate through direct investment programs. However, many medium-sized firms have found great difficulty in finding their way about in unknown markets in which the choice of a local partner is a complicated matter for someone simultaneously facing various kinds of technical and economic uncertainty. Hence, it is not surprising that in these cases there has been a preference for selling technology in a "package", thus avoiding the subsequent commercial handling of the technology sold. In the same way, the limited size of the firms involved also seems to have been a contributing factor, for it has generally placed a significant limit on the availability of capital and on the increase of liabilities of the firm owning the technology.

To the abovementioned difficulties regarding the export of finished goods on a permanent basis, those firms which produce capital equipment must add the fierce competition which exists in highly differentiated products like most production goods. The lack of information on the part of clients from other developing countries with regard to capital goods manufactured in Argentina makes their export on an individual basis difficult, especially if they must compete with better known international brands, which enjoy prestige and support from commercial organizations already set up in the potential markets.

As a result, various suppliers of capital goods seem to have realized that it is desirable - in order to be able to place their products - to provide broader "packages", either by themselves supplying the engineering and the rest of the plant components, or doing so in conjunction with service firms.

Illustrative examples of this kind can be seen in Table 1. Before selling a complete plant in Bolivia, Laboratorios Bagó S.A. had had several years' experience of exporting antibiotics to that market. On the other hand, Argental S.A. (which exports through Phoenicia S.A., which is an international trading company) had managed to export bakery equipment to other Latin American countries on various occasions, but it was really successful and enlarged its

scale of operation when it offered complete bakery plants.

So far we have examined the dilemma posed by the choice between exporting directly or transferring a "package" of investment and technological knowledge. We have seen that the latter option has often been imposed by autonomous decisions made by the importing country. However, the transfer of technology may take place both in the form of a manufacturing license or through the sale of a complete plant.

We shall now centre our attention on these two possibilities.

Most of the Argentine firms we consulted showed no interest in signing license contracts. What is the reason for this attitude?

Mainly, it would seem that this reluctance is connected with the nature of the knowledge held by the firms. In fact, this does not involve - except in a few exceptional cases - new basic engineering at the international level. It is rather a matter of recreation of relatively widespread knowledge for a more efficient adaptation to the technical and economic conditions prevailing in poorly developed markets. For this reason, the very "applied" nature of the technology makes it not legally patentable, and it can only be sold in "embodied" form as part of a wider complex of goods, equipment and services.

Likewise, the fact that a medium-sized firm is not in a position to deal with the legal difficulties arising from non-compliance with a license contract, difficulties which could force it to enter into litigation abroad, also operates in the same direction. Therefore, it is reasonable that it should feel more secure selling a package of goods and knowledge whose value is received against delivery in a similar way to any other export.

## Who Sells?

Two categories of participants have already been distinguished in the export market under study: on the one hand, there are a few subsidiaries of multinational corporations, and on the other, a large number of firms backed by local capital.

It is interesting to add that nearly half of the latter are from industrial areas in the interior of the country, of which we should mention Rosario, Santa Fé, etc. Their origin is varied, although the majority are relatively new firms which have developed into their present state during the most recent stage of the import substitution process, that is, beginning at the end of the fifties.

Several of these firms were set up on the basis of professional groups in close association with provincial universities. This is the case with the Faculty of Chemical Engineering of the Province of Santa Fé, whose professional staff founded several firms active in the international market, among which SEI Ingeniería S.A. and Nisalco S.A. are outstanding examples. Others developed as suppliers for the public sector in specific, highly technical branches; examples are EMEPA S.A. in railway equipment and Lito Gonella e Hijo S.A. for the oil industry.

The important fact to be emphasised is that most of these medium-sized firms have achieved specific competitive advantages on the basis of their own technological assets (an "intermediate" technology?) which have enabled them to have the lead in relatively less developed countries over both domestic firms and the large multinational corporations.

## To Which Markets?

It has already been said that Latin America has constituted almost the only market for the kind of exports studied in this paper. What can be the reason for this situation? In principle, it does not seem unreasonable to consider that geographical proximity as well as cultural, linguistic, etc. affinities play a significant role in explaining the phenomenon. This is not a hypothesis lacking a basis in reality. It receives additional support from Japan's experience, a country which exports 70% of its chemical plants to other South East Asian countries, relying strongly on aspects such as those mentioned. 36/

However, the phenomenon does not seem to be restricted to advantages related to freight and other elements inherent in geographical proximity.

The theory of international trade usually makes us think in terms of a single world market, of the kind which functions for commodities. The product cycle theory also reasons in terms of the technological leadership of a single country: the United States. The technology created there is first transferred to Europe and Japan, and as it becomes sufficiently mature and standardized it flows to the remaining countries. This conception, in our opinion,

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36/ Christopher Freeman, Chemical Process Plant: Innovation and the World Market, National Institute Economic Review, London, 1968.

requires some qualifications. In the first place, it does not seem so clear that there is a single market for the kind of goods we are studying. The differences represented by the technological make-up of the projects, the various levels of investment necessary per unit of production, etc., are clear examples of the uniqueness of these transactions. Why not argue, then, in terms of a fragmented international market, or rather in terms of submarkets or "interstices" in the world market, which allow considerable variation in the goods traded and in the production functions employed?

If we add the fact that certain Latin American markets are sometimes marginal for the large corporations, but permit medium-sized Argentine firms to carry out business which is significant for the local firm, the validity of such "submarkets" or interstices is reinforced.

In the second place, the product cycle theory should perhaps be reinterpreted in the light of the empirical evidence gathered in several semi-industrialized countries where the phenomena of technology exports and direct overseas investment have also been observed. There are nearly a dozen countries with a certain experience and industrial maturity, which seem to be reproducing a number of "tertiary" cycles in the transfer of technology to less developed countries. 37/.

## The Role of Agents Complementing the Manufacturing Sector in This Type of Exports

The industrial plant and engineering works export phenomenon so far described has tended to be viewed as the almost exclusive result of the accumulation of experience in the manufacturing sector. However, a more complete view of the subject should include at least three types of agents which provide services and whose participation is a necessary condition to stimulate the sale abroad of technological packages like those previously presented. We are referring to: 1. consulting firms, 2. trading companies and, 3. financial institutions. Let us look at the role played by each one.

The first seem to be called on to play a double role in this field. On the one hand, their tangible contribution by way of

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37/ In some cases - especially Brazil - the recently instituted economic policy instruments grasp more adequately the dynamic nature of this industrial maturation and technological process, by specifically supporting exports of domestic technology.

services to the manufacturing firm is expressed in terms of the drawing up of the basic and detailed engineering, in the handling and supervision of the assembly and starting up of the plant, etc. In this respect the engineering firm must match the contribution of the suppliers of the basic process with the manufacturers of capital goods, undertake the international search for complementary technological knowledge, etc. On the other hand, the engineering firm can exercise an indirect effect on the demand for Argentine technology to the degree that its specific activity extends to other markets. 38/

Let us examine the foregoing in more detail. It is clear by now that many medium-sized and small firms have managed to develop a certain autonomous technical capacity, valuable in third markets. However, there is a significant difference between having such a capacity available and being in a position to transfer it. The gap between the two concepts is in most cases determined by the possibility of formalizing and systematizing the knowledge which the firm possesses, in order to make its transfer as a negotiable technological package feasible. It could be argued, in the light of some examples quoted in a previous paragraph, that many firms develop these functions internally, and even that these dependent engineering organizations behave like suppliers of services to third parties. This is true in the case of firms which have from the outset hired professionals or technicians, a fact which often depends on the technical background of the owners. 39/

In many other examples the firm's technological development has been carried out by non-professional qualified personnel, in a completely empirical fashion, only for them to find, at the time of completing a plant export contract, that they lack the necessary formal engineering (detailed plans, operating standards, etc.). It must be remembered that, even if the purchaser saw a plant in operation - a copy of which would be built for him - he would not be prepared to receive the embodied technology except in the form of technical parameters: formulae, detailed plans, process manuals, descriptions of procedures, etc.

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38/ Christopher Freeman, op. cit.

39/ The subsidiaries of multinational firms which have locally developed large engineering departments have also begun to offer services to third parties or to other subsidiaries within the corporation. This is the case with Ducilo in Bolivia and Brazil, Fiat in Colombia and Venezuela, Olivetti, etc.

On the other hand, the contracting of an engineering firm would enable the business man to free himself from the work of processing and organizing the elements of technical knowledge required for the project, from directing the construction, assembly, starting up and operation of the new production installations, etc., and to benefit from the experience of a consulting firm.

Although it is true that larger scale firms, which have previously sold industrial plants in the home market, have their own engineering services, they are not for this reason in a position to undertake all the adaptations and developments which a particular transaction requires, given its special features. There are always specialized areas in which it is necessary to call on outside engineering, since studying and developing them within the firm itself would not be justified. For example, when SEI Ingeniería agreed to the sale of the integrated slaughterhouse-meatworks to Cuba, it contracted the engineering connected specifically with meat treatment with a consulting firm specializing exclusively in this subject.

On the other hand, the evidence from previous studies suggests that there is a strong correlation between the broadening of the foreign consulting market of a country and the subsequent increase in exports of plants and engineering works by that country's firms. Freeman has shown - as an example - the close links observable in the case of the chemical industry between the origin of the suppliers of the processes and the construction firms chosen for the projects which use these processes. 40/

This sequence would appear to some extent a natural one, given that the consulting firms which draw up projects are probably implicitly defining the technical parameters for future contracts or tenders. In fact, by developing the conceptual engineering, both basic and detail, the engineering firm is probably establishing the principles according to which the component and machinery suppliers must adapt their goods. Therefore, it can be assumed that the consulting firm will work with the equipment most familiar to it, that is, that most commonly used in its own local market. Hence, sales of engineering services indirectly encourage the export of the domestically produced components of the production installations which are designed, whether these be plants or infrastructure works.

The international trading companies also seem to play a

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40/ Christopher Freeman, op. cit.

significant role in coordinating, negotiating and administering the export of industrial plants or complete works.

The international trading companies are the real agents of many deals of this kind, since in the course of their activities they are the first to detect the needs of the markets in which they operate and they can then proceed to formulate projects originating in their base country.

In principle, it is clear that the services of these companies offer an advantage to those bidders whose size does not justify their setting up their own internal export department; either because their export-total sales ratio is low or else very irregular. 41/

Thus, the international trading company may operate by subcontracting locally or internationally all those goods and services necessary for delivery of the complete operation. It can select the technology offered by an engineering firm, contract the supply of capital equipment and goods forming part of the plant or works by calling on international brands when technical conditions so require, deal with cost aspects, legal matters, insurance and transportation items, etc.

The development of international trading companies enables a better exploitation of medium-sized and small firms, since they are unlikely to be able to gain access to the international market except through a conglomerate coordinated by those entities which control foreign trade mechanisms. 42/

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41/ Jaime Campos, in his paper "La actuación internacional de la pequeña y mediana empresa: un estudio empírico en el sector máquinas-herramientas de la República Argentina, quotes the example of a firm producing tool machines, located near to San Francisco, Córdoba, whom a firm from Ecuador requested to build a similar plant to the one it operates at present. After evaluating the deal, the Argentine firm had to refuse since the administrative effort involved in undertaking such a contract abroad would have endangered the continued existence of its local operation. See Intal, Serie Estudios Nº 2, Bs.As., 1977.

42/ A new alternative to the participation of small and medium-sized firms in the international trade are the so-called export consortia, through which a number of producers form an association for the purpose of minimizing the administrative costs of services involved in foreign trade. Even though there is little experience in this area in Argentina, the case of the sale

As far as the connection between the financial sector and exports of plants or complete works is concerned, the basic problem is the risk involved. In fact, it has already been explained that the very scope of the transactions to be undertaken in many cases exceeds the extent of actual liability of small or medium-sized firms, and also of service firms (engineering or international trading companies), which by their very nature lack broad-based assets. In these circumstances, there is a clear need for a financial broker to underwrite the risks involved in the deal.

The subject of risk, and its connection with the financing of the kind of exports studied here, is central to the design of any strategy in this area. Before going any further, it must be recalled that the bidders in an international tender must first guarantee their supply by opening a letter of credit, which for the supplying firm means freezing a significant amount of working capital. Subsequently, when the contract is signed, this firm must guarantee the satisfactory completion of the project in the same way.

If it is borne in mind that we are concerned in all cases with long term projects (more than a year), we can have some idea of the amount of financial resources required by this kind of export, apart from the funds specifically allocated for carrying out the work itself. This is without taking into account the risks involved in the purchaser's possible bankruptcy (commercial risks) or arising from unexpected political situations in the country where the project is being carried out (extraordinary risks) which could prevent payment.

An alternative way of covering these risks, as well as guaranteeing satisfactory completion of the work, lies in taking out specific insurance policies (export credit insurance and satisfactory completion assurance). However, granting of the latter is not very common either in this country because of the aforementioned difficulties.

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of the "turnkey" hospital to Abidjan, Ivory Coast, can be mentioned. In this transaction the medical instrument suppliers participate as a unit in a consortium in association with a consulting firm (Latinoconsult S.A.) which actually obtained the contract and in turn set up a pool with a firm of architects which is providing the design (Clorindo Testa y Asociados) and with a construction firm which is building it (Sebastatián Maronese e Hijos S.A.)

As we shall see later, Brazil has recently introduced legislation on this matter with a view to encouraging exports of services, works and industrial plants, by authorizing the public sector to grant vouchers through the National Treasury whenever necessary for international contracts. In this way, the State has decided in certain circumstances to underwrite the risk inherent in these transactions.

## IV. LEGAL ASPECTS CONNECTED WITH THE EXPORT OF INDUSTRIAL PLANTS AND ENGINEERING WORKS

In this section the subject of the export of technology is analyzed from the legal angle. The section is divided into two parts. The first one examines the basic structure of a model export contract for manufacturing plants or structure works. The material presented reflects the different alternatives found during our analysis of the cases referred to in previous sections.

The second part of this Section summarizes the legal rules applicable in Argentina to the sale of complete plants and engineering works abroad. Current legislation is briefly compared with some of the measures adopted in this field by Brazil in order to put into perspective some of the most outstanding differences in the economic policy followed in this matter by the two largest technology exporters on the Latin American scene.

### a. Structure of a Contract for a Plant or Complete Works Export

At this stage of the research, the highly heterogeneous nature of the kind of transactions which can be covered by the "turnkey" formula is clear. Because of these very varied situations, it is practically impossible to speak of a "model" contract applicable to every case.

In this part, the most outstanding aspects of some of the contracts studied will be summarized, both from the point of view of the items that make up the package transferred and of the special features of the negotiations involved. This summary will, of course, reflect the most usual clauses, but must in no way be taken as an exhaustive list.

As has already become clear, the turnkey formula (in its generic meaning) implies that the supplying firm undertakes to furnish all those services, and to contract all those supplies, necessary to hand over the production unit in operating condition. Therefore, a sale under this formula usually involves provision of the following items:

i) Basic, Detail and Process Engineering

The relative incidence of these items on the total value of the contract usually varies noticeably, depending on the kind of

transaction and the branch of industry involved. Freeman 43/, for example, found that in a sample of cases of exports of complete plants belonging to process industries, payment for basic engineering, design and know-how ranged from 10% to 30% of the total price.

It is important to note that in the cases studied here the basic engineering is seldom included in the valuation of the plant. In those cases in which it is in fact included, it reached a maximum of 7% of the total value.

The lower value assigned to basic technology in the contracts studied here in comparison with Freeman's data seems reasonable if we consider that, unlike the examples studied by this author, the transactions analyzed in this paper do not involve the transfer of a "package" of technological knowledge which is new at the international level. Rather, in the contracts signed by Argentine firms, the basic engineering seems to be less relevant than the detailed engineering. In many cases, the former is not even mentioned, while in others it is defined generically in the operating objective, that is, when the uses and functions of the production unit being sold are detailed.

As far as the detail engineering is concerned, it is usually included in an item entitled "technical documents and plans", which covers the know-how included in the transaction, and contains a number of detailed plans, layout and circulation designs, operating manuals, etc.

ii) Patents, Brands and Designs

The contracts examined almost always include a clause aimed at covering aspects relating to technology protection legislation and industrial property regulations - either from the point of view of the vendor or third parties.

In the first case, it is customary that whoever sells a plant should transfer all rights to patents, brands and designs registered as its property, which are part of the design or work exported. The aim of this transfer is to ensure that long-term use of invisible assets of this kind in the plant in question does not give the vendor firm any right to future payments or, in other words, that it will have no right to receive royalties, since the contract price is total and final.

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43/ Christopher Freeman, op. cit.

Likewise, it is usual for the vendors to make themselves responsible against claims by third parties for failure to comply with copyright laws; therefore, the purchaser receives a guarantee that the use of the plant's processes and designs does not involve any infringement of the rights of third parties in this respect.

iii) Materials, Self-Manufactured Equipment and that Sub-Contracted from Other Suppliers

Given the characteristics of turnkey contracts, the vendor must not only undertake to provide the goods he manufactures himself, but also those produced by third parties.

The technical specifications of the plans often make it necessary to acquire certain equipment in other countries, and in this case the vendor must accept responsibility for its delivery at the time and in the way laid down in the work timetable.

However, the most important aspect of the provision of materials, goods and equipment involved in the plant or work arises from the need to guarantee that it conforms to the technical specifications and that it operates satisfactorily. To do this, it is usual to draw up very detailed clauses referring to the right to inspection and technical control by the purchaser. Very often, the purchaser does not exercise this right directly, but does so through a recognized inspection firm.

When goods supplied by third parties are involved, the work contractor must ensure that the guarantees he obtains for these goods are as broad as those he has given for the technological performance of the goods or services purchased, so that he does not incur additional risks.

iv) Construction of the Civil Work, Assembly and Plant Start-up

To carry out all the technical tasks involved in the construction and starting up of the plant, the vendor appoints a works administration which exercises the power of final decision in this process. On the other hand, it is usual for the purchaser to provide the auxiliary technical staff and the labor to carry out all the stages mentioned, all of whom must work under the supervision and instructions of the vendor's staff.

Once the plant has been built and assembled according to layout and technical specifications, a provisional plant receipt certificate is signed and the testing period begins.

Tests are carried out in 3 stages. The first is that of "trial run" testing, followed by load testing, that is, with the plant in normal operating conditions. In the third stage, the parameters indicating compliance with design and specifications are measured, and if these are satisfactory, the plant is finally handed over. If the test results are unsatisfactory, the vendor is responsible for an adjustment period and for seeing that the technical and output parameters laid down are complied with. If the adjustment period has gone by without satisfactory results, the purchaser has the right to claim penalty payments for delays and for failure to comply with the plant's technological performance standards. These penalties are usually fines, which do not free the vendor from the obligation of solving the bottlenecks which have been discovered.

v) Technical Advice, Personnel Training and Plant Administration

The vendor's obligation to provide technical advice usually lasts until the plant is finally handed over, in which case its administration passes from then on into the purchaser's hands. However, it is normal for a plant to present certain operating difficulties during its initial stages, so that two further services are usually contracted separately. On the one hand, technical assistance during the post-delivery period, for a time which exceeds that covered by the plant guarantees. On the other hand, on some occasions the appointment of a technical manager is agreed to, who is chosen by the vendor - but paid for by the purchaser - and is in charge of plant operations.

Regarding the training of the purchaser's staff, appointed to handle and repair the plant, this is selected by the plant owner. Training varies according to the type of plant involved. Thus, when there is a similar plant in operation in Argentina, it is usual for the staff concerned to come here for <u>in situ</u> training.

vi) Supply of Spare Parts and Transfer of Future Improvements

When the supply of materials, goods and equipment that make up the plant or work is contracted, a percentage of customary spare parts, which the purchaser chooses from a list drawn up by the vendor, is calculated, the cost of which forms part of the contract.

To guarantee the purchaser of the plant a future supply of necessary spare parts, the practice is that the vendors commit themselves for a period of several years after final delivery to remit the spare parts requested at prices current on the international

market on each occasion.

For this purpose, the vendors make themselves responsible for maintaining an adequate stock of spare parts for the production line which has been sold, and also for informing the purchaser if certain items are discontinued, so that the latter can make suitable provisions in time.

A special element in some of the contracts analyzed is the clause by which vendors commit themselves, over a considerable period of time, to transfer free of charge all innovations or modifications they develop in the technology pertaining to the plant sold.

vii) Miscellaneous Factors

As far as prices are concerned, it is predictable that contracts of the sort which refer to work carried out over an extended period of time should be subject to devaluation of the currency in which they are signed, and also to rises in the cost of labor, equipment, etc. Therefore, it is usual to establish price adjustment mechanisms on the basis of mutually acceptable rates.

Finally, it should be emphasised that international contracts involve numerous problems in cases of litigation, not only because of the involvement of the jurisdiction of several nations, but also because of technical difficulties in the interpretation of many of the clauses, specifications, etc. It is for this reason that in most of the cases known the parties have decided to establish a mutually satisfactory arbitration mechanism, thus giving up in advance the possibility of resolving the matter by means of a lawsuit.

## b. Export Promotion of Complete or Turnkey Plants

Up to the present, in order to promote this kind of exports, Argentina has put into practice similar instruments to those applied to stimulate exports of manufactured products in general, that is, the granting of tax and credit benefits.

In recent years, some countries have developed new legal mechanisms intended to encourage this kind of export, the outstanding one being direct State participation with the aim of absorbing risks arising from the concession of guarantees. This participation is expressed in practice by the granting of vouchers to the domestic firms which take part in international tenders in which the kind of guarantees described in the previous section are an indispensable

requirement. However, Argentine legislation has been restricted to granting refunds and allowing specific lines of credit. In different ways, these commercial policy instruments produce a rise in the effective exchange rate received by the exporter. In the first case, it is an ad valorem rate applied to the value of the export, which acts as summary of the total tax rebates which the Treasury wishes to grant to the exporter. In the second case, the firm obtains an advantage by having access to lines of credit at lower interest rates than the market average. The lines of credit can be set up for various stages of the project, such as the anticipation of funds for manufacturing the plant components, or for financing the rediscount of the exchange letters issued by the purchaser. In the latter case, the vendor firm is in a position to improve its offer by proposing better terms of payment without absorbing any additional financial costs. However, none of the credit instruments described solves the problems set out in the previous section, which mostly affect small and medium-sized firms: this can only be done by an adequate insurance system which would enable a firm to offer normal operational guarantees without which it is practically impossible to trade in this field.

In the case of Argentina, legislation for the granting of rebates for the sale of complete turnkey or complete plants or works is contained in Decrees 4884/73 and 2786/75, the latter currently in force. Credits were originally covered by the Central Bank's Circular B1112/74. Subsequently, the regulations thereby laid down were slightly modified in Circulars RF20 and RF21/77, and are currently governed by RF98 and RF99/77.

However, it is not the mechanism itself regarding tax and credit benefits which presents discontinuities in Argentine legislation. On the contrary, the main point on which the regulations mentioned present conceptual differences has been the actual definition of the kind of transactions subject to promotional backing. It is a question, then, of deciding whether the promotional regulations should protect exports of industrial plants only, or if it should have a wider coverage to include the sale of engineering projects and the subsequent construction of civil engineering works for the provision of services, which are not - obviously - manufacturing plants of the kind included in the promotional regime.

The solutions adopted have been different in each of the decrees mentioned, which will now be analyzed.

Decree 4884 was passed on 23rd May, 1973 44/, and was never

44/ It must be remembered that on 25th May 1973, the authorities had to hand over power according to the result of the

enforced because it lacked the necessary by-law, and was finally repealed by Decree Nº 2786 itself. However, this decree provides some interesting background to the subject. It assumed - with a very broad vision for the level of experience available at that time - that the promotional system for exports of the kind studied here should not be restrictive. That is, that encouragement should not be limited exclusively to the physical components of an exportable unit, but that it was appropriate to add the concept of services, which in modern foreign trade are almost always connected with the supply of technological "packages" more complex than the simple flow of physical merchandise.

This view of the problem seems to have traditionally faced a certain degree of opposition on the part of institutions responsible for the enforcement of the promotional measures, which has in the end produced a shift towards a more restrictive legislation in this area. To some extent, it could even be thought that the legislation on exports of plants and complete works in this country has been more the result of adjustments made by the administration responsible for preventing possible abuses, than the consequence of a policy specifically aimed at increasing sales of this kind. In fact, the institutions in question have encountered serious difficulties in defining the concept of "services", and have therefore drawn the conclusion that broader legislation would give rise to the collection of refunds on exports which were not in fact any such thing.

Thus, no further statement can be made on the effects that more far-reaching promotional regulations would have on the export of domestically produced goods and services, even at the cost of some cases of illegitimate collection of promotional benefits.

Decree 4884 - even though it could be subject to further improvement - had some of the more far-reaching characteristics referred to. In the first place, it made no distinctions regarding the granting of the established benefits between exports of industrial plants and any other kind of engineering complex, as long as the latter were sold under the "complete" or "turnkey" formula. Even more important, it gave special importance to everything "which is the product of intelligence and the services which operate as indispensable auxiliary factors in trading". 45/ The

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elections held, so that the decree was passed practically simultaneously with the transfer of power.

45/ All the passages in inverted commas correspond to quotations from the articles of Decree 4884/73.

introductory clauses of the decree in question revived precisely the need for the proposed incentives to include the "idea of services which aid the export of know-how, with a maximum local added value". Thus the intention was that "the stimulus given to the export of physical goods" should be extended to intellectual services, "including process engineering, detail and construction engineering, the management and carrying out of works, research services and studies forming part of exports of domestically produced manufactures or independent of the same".

Implicit in these considerations was the idea, accepted in the literature of recent years on this subject, that there exists a close link between the export of the good we could call in its broadest sense "engineering" or "consulting services", and the expansion in sales of capital goods and/or plants or complete works. This sequence has already been analyzed in the previous section, and it definitely seems to be a factor on the new intra-Latin American export scene. If this were so, the need to offer more integrated technological "packages", which require a more complex conception and execution, would indicate the advisability of having promotional mechanisms more appropriate for the development of the sequence we have described.

It is realistic to recognize that, even though the spirit of Decree 4884 anticipated a modern view of the way in which access to international markets for more technologically complex products is gained, the instrumental measures it proposed lacked a detailed structure that would have enabled the design of an accurate system for the application of the regulations laid down.

The decree in question established two different kinds of refunds according to the kind of transaction. The first applied to those "turnkey" sales in which less than 50% of the value of the contract involved physical goods, the remainder consisting of "technical services" related to the package of physical goods. In this case the corresponding refund was applied independently to each individual good exported, and then by means of a mathematical formula of averages calculated on these refunds an aliquot was obtained, which was applied to the proportion of technical services contained in the contract.

The second kind of refund was aimed at the export of services when the previous percentages were not complied with, or when these services were the only object of the transaction. In this way, the export of technical services, operation engineering, management and execution of works and/or research services and studies was facilitated. But in this case, the level of refund applicable was subject

on each occasion to an administrative decision limited only by a minimum level.

Given the lack of the bye-law, Decree 4884/73 did not come into force - as mentioned previously - and more than two years went by before a new set of regulations for the promotion of the kind of export studied herein was put into practice. Such regulations are contained in Decree 2786/75, which repealed the previous one and is at present in force.

Unlike its predecessor, the 1975 set of regulations was of a more restrictive nature with regard to its area of application. On the other hand, it has a much more detailed and effective operating methodology, which was lacking in Decree 4884.

In fact, the intention of the current decree is to encourage exclusively exports of industrial plants, and therefore it excludes transactions involving the sale of civil engineering works or those for the supply of services which are not strictu sensu manufacturing establishments.

Thus, the introductory clauses of the decree referred to limit the scope of its application, when they state that "the level of development achieved by Argentine industry puts it in a position to produce turnkey or complete industrial product manufacturing and/or processing plants".

The benefits laid down by Decree 2786 consists of a refund determined in the first article, which was later fixed at the equivalent of the maximum level of refunds corresponding to the export of manufactured exports. Likewise, this initial article establishes explicitly that the benefit quoted only applies to plants of an industrial nature and to those technological services which make up the "package" of which the plant consists, and which are listed quite specifically.

Unlike its predecessor, the decree analyzed distinguishes between the "turnkey" and "complete" formulae, considering that the former includes the construction of the civil engineering work which does not form part of the transaction in the second case. On the other hand, both formulae include supply and installation of the respective elements or goods, the supply of the operating method and assistance in starting the plant up, including training of the staff necessary for its operation.

Except for the technological and advisory services included in the definition set out in the previous paragraph, the remainder of the sales of this kind are excluded from the benefits laid down

- even if they are part of an exported turnkey package - in the same way as the construction of the civil work is in the case of a "turnkey" operation 46/.

On the other hand, the decree studied upholds the principle of encouraging exclusively the domestically produced aggregate value, and therefore the established refund does not extend to the amounts corresponding to goods and technology of foreign origin, nor to overseas trade commissions, nor freight and insurance not undertaken with domestic firms.

For this purpose, it defines as of foreign origin a technology which requires royalties or similar payments abroad for its use.

These restrictions on the granting of refunds do not mean that technology and goods of foreign origina cannot be incorporated into the construction of the exported plant when circumstances so require. But as the essential aim of the regulations is to promote the sale of plants involving domestically produced technologies, the percentage of goods contracted abroad which can be included in the agreement is limited to 30% of its total value (excluding freight, insurance and profits).

So far, we have presented the Argentine regulations and background.

Let us now look at the contents of the Brazilian decree of 2nd September 1976, by which "incentives for the export of services are created and granted" in that country.

The introductory clauses of these regulations incorporate many of the most modern ideas on this subject, since they recognize that the export of services "is a fruitful area for the earning of foreign exchange, besides providing direct and indirect support, of the most significant kind, for the sale overseas of domestic merchandise". And it adds, "selling services is as profitable and beneficial as selling goods, and it must further be pointed out that, after a certain stage, when the export of capital goods shall be aimed at, the export of industrial engineering projects will become decisive".

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46/ The exclusion of the refund for the civil works really seems unjustified, since it concerns an area in which local building firms have acquired a great deal of exportable experience. Likewise, civil engineering construction involves a large number of exports of physical goods with special features, which are unavailable in the client countries.

It has been noted in the foregoing paragraph that the Brazilian decree takes up the idea of exports as an unbreachable sequence between engineering-services-physical goods, and in this respect it recognizes the direct and indirect effects of engineering and services exports on the foreign exchange balances. Likewise, the regulations in question grant substantial importance to the modernizing effect on the domestic market of the consolidation of a consulting services structure and especially to the greater absorption of skilled labor.

So far, it could be considered that the decree of 2nd September 1976 reiterates - with greater precision because of wider experience - the general guidelines of Decree 4884/73 in Argentina. However, the Brazilian regulations go further, since they make two substantial innovations, as follows:

a) article 2 establishes that sales to local engineering firms of goods and equipment produced domestically - but intended for use in carrying out works contracted by the latter abroad - will enjoy the same tax benefits which would correspond to the export of such goods. This means that the sale of machines, equipment, vehicles, spare parts, etc., in the domestic market to an engineering firm - which in turn uses them in an export project - gives the right to collection of the same refund and other tax advantages as if the goods had in fact been exported.

This equalization of export benefits for sales in the domestic market is undoubtedly a great incentive to competition between suppliers of capital goods and equipment, who will receive a subsidy for incorporating their goods into more complex technological projects instead of exporting them individually.

b) article 4 authorizes the Treasury to grant, in favor of domestic firms involved in the supply of services, execution of works and/or supply of goods abroad, guarantees from the National Treasury to cover risks of a breakdown in the deal or failure to fulfil the contract, whenver this guarantee is normally required.

With this provision, the Brazilian government takes a completely novel step within Latin America regarding the problem of assessing and accepting the risk inherent in the international sale of plants and complete technological "packages".

The section on legal and institutional aspects concludes here. The next one, the last in this paper, briefly summarizes the main results achieved at this stage in the research and points out some of the topics which require attention in this field.

## V. CONCLUSIONS

This paper is an initial attempt to study a subject which has rather been neglected up to now. We refer to the growing ability shown by Argentine industrialists to design and export within the Latin American area complete industrial plants and engineering works for the provision of services (hospitals, airports, oil pipelines, etc.)

So far, the technological situation in Argentina has been studied almost exclusively from the point of view of its position as an importer of technology. This is obviously correct, since this is undoubtedly the dominant feature. However, it seems important to note that the last five years have shown a growing number of firms - both domestic and subsidiaries of multinational enterprises - which have been successful in selling complete technological "packages" in various Latin American countries, especially Bolivia, Cuba, Uruguay, Paraguay and Chile. Simultaneously, we can observe a growing number of cases of the multinationalization of local firms which have carried out direct investment programs in one or more countries in the region, transferring to them both capital and their own technology.

Even if this is not a subject for analysis in this study, it is worth noting that a similar process seems to be in full swing in both Brazil and Mexico.

The empirical evidence concerning Argentina gathered in this study indicates several points of interest. Among them: a) a high proportion of the contracts for sales of complete plants corresponds to sub-branches of the Food and Beverages sector and the Chemicals production area; b) there is a substantial difference in magnitude between the contracts signed for the design, construction and delivery in operation of complete industrial plants and those others which involve the execution of engineering works. The latter are substantially larger than the former, even if we remove from the universe studied the case of the oil pipeline built by Techint in Peru, the size of which far exceeds that of the other contracts which make up the sample; c) in several of the cases studied, there are clear signs of international competitiveness shown by the fact that contracts have been obtained in open tenders and in competition with one (or more) alternative bid(s); d) the comparative advantages of the local industrialist (or engineering firm) seem to be based not only on matters inherent in geographical proximity, cultural and linguistic affinity, etc., but also on the fact that the industrialist is in a position to supply a complete

"package" more "suitable" for the internal circumstances of the recipient country with regard to plant scale, degree of automation of the production line, nature and availability of raw materials required, degree of complexity of maintenance technology, etc.

In the light of such empirical evidence it is clear that at the moment we lack a sufficiently comprehensive theory that will explain the points observed. Likewise, as far as economic policy is concerned, it is well known that the subject is still too new to expect a great deal of experience in management of policy instruments. We consider that at both levels - that of explanatory theory and the formulation of economic policy instruments - new contributions which may enable us to improve our understanding of the problems and the daily handling of them are necessary.

Regarding theory, this paper holds that the growing export capacity in complete industrial plants and engineering works of countries like Argentina is the result, on the one hand, of the "adaptive" technological efforts carried out by numerous local industrialists to enable them to adjust foreign technological designs to the special characteristics of the local environment.

These efforts, accumulated over time, finally generate a "package" of their own technological knowledge with a resale value in third markets.

On the other hand, the fact that the product demanded (layout of complete plants, engineering design, technical assistance for assembly, start-up and management, etc.) is far from being homogeneous and allows a substantial level of specific adaptation according to the circumstances, also operates in the same direction - that is, favoring the export of local technological designs -. This is what makes each design require some degree of adaptation work, which partly reduces the appropriateness of the "portfolio" designs and thus weakens some of the advantages of the big international engineering firms or of the traditional licensors from the developed world.

The formulation of economic policy instruments in this area has suffered from two basic difficulties, besides problems of administrative handling. On the one hand, the very definition of what it is desired to promote, which inevitably involves a certain degree of arbitrariness, given the extremely broad range of items which come under the heading of "technological services". On the other hand, and as a function of the foregoing, restrictive handling aimed at avoiding possible abuses in many cases finally acts as a brake, even in situations in which the treatment of the technological knowledge export sector as an "infant industry" would

suggest the advantage of a different approach by the Public Sector. At both levels a new conceptualization regarding public policy would seem advisable. 47/

47/ When this paper was already in print, we came across a recent statement by the Undersecretary for Foreign Trade, indicating that the regulations governing tax refunds for exports of "turnkey plants" was soon to be altered, extending the coverage of the promotional system to exports of technological services not at present covered by Decree 2786. See La Nación, Friday, 31st May, 1978.

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