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THE TRANSFER OF TECHNOLOGY IN THE
INDUSTRIAL DEVELOPMENT OF BRAZIL

GENERAL ASPECTS OF THE PROBLEM

Study prepared by

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Preliminary note

The present document, "The transfer of technology in the industrial development of Brazil: general aspects of the problem", and the sectoral studies which complement it, i.e., "The transfer of technical know-how in the textile and clothing industries in Brazil" (E/CN.12/919), "The transfer of technical know-how in the machine-tool industry in Brazil" (E/CN.12/920) and "The transfer of technical know-how in the steel industry in Brazil" (E/CN.12/922), were prepared under an agreement concluded between ECLA, the Inter-American Development Bank (IDB) and the Division of Public Finance and Financial Institutions of the United Nations Department of Economic and Social Affairs.

The preparation of this particular document, and indeed the execution of the project as a whole, has been made possible by the invaluable collaboration of Mr. Nuno Fidelino de Figueiredo, a noted Brazilian industrial economist with vast experience and understanding of this field, he was responsible for directing and organizing this project from the very beginning, conducting the necessary field work in Brazil and preparing the corresponding documents. The sponsor organizations wish to place on record their gratitude to Mr. Nuno Fidelino de Figueiredo for his meritorious and enthusiastic co-operation in this project.

They also wish to express their gratitude to Mr. Luigi Spreafico and Mr. Franco Vidossich, the consultants, who were responsible for preparing two of the sectoral studies.

Lastly, they wish to express their thanks to the Institute of Economic and Social Planning (IPEA), a subsidiary body of the Brazilian Ministry of Planning and General Co-ordination, without whose valuable co-operation in supplying information and background material the present project could hardly have been brought to a successful conclusion.

Chapter I

BACKGROUND AND MAIN CONCLUSIONS

1. Background to the present study

This work is the last in a series of studies on the transfer of industrial technology to Brazil from abroad which is itself related to another series of studies on the same subject carried out under the sponsorship of the United Nations and the Inter-American Development Bank in other Latin American countries and other regions of the world.

This series of studies, which was prepared in response to the concern expressed by member States of the United Nations at various meetings and embodied repeatedly in official resolutions and in reports prepared in the light of the latter by the Secretary-General, has a background history within the United Nations which is worth tracing briefly in order to place the present study in the perspective of current preoccupations regarding international co-operation.

The study on the transfer of industrial technology to the developing countries owed its being to the recognition by the United Nations Advisory Committee on the Application of Science and Technology to Development of the fact that the traditional and most commonly used channels for the effective transfer of operational know-how are agreements signed between an enterprise or organization (public or private in the industrialized country in which the know-how originates and on interested enterprise in the developing country. The Committee therefore agreed that the empirical study of the application and effects of the various types of agreements on the transfer of technology was of major importance, especially for determining principles and criteria for the adoption of arrangements and institutions that would permit the more effective application of technology from abroad and promote the development of national research capacity. To that end, the Committee requested the Secretary-General to initiate case studies, for selected countries and industries, of the experience acquired in the sphere of the transfer of technology to developing countries, especially through enterprise-to-enterprise agreements.

Within the United Nations, the various initiatives and activities associated with this set of studies were centralized in the Division of Public Finance and Financial Institutions of the Department of Economic and Social Affairs. While this project was being developed, other Latin American agencies, such as the Inter-American Development Bank and the Organization of American States, became interested in the same topic. An agreement for the execution of studies on the transfer of technology in Brazil was accordingly signed between United Nations Headquarters (represented by the Division of Public Finance and

/Financial Institutions

Financial Institutions of the Department of Economic and Social Affairs and the semi-autonomous United Nations Institute for Training and Research, the Economic Commission for Latin America, and the Inter-American Development Bank.

A similar agreement was signed almost simultaneously, but without ECLA's participation, for the execution of similar studies in Argentina, which were entrusted to the Centre for Economic Studies of the Torcuato di Tella Institute, as part of a wider range of studies on scientific and technological development sponsored by the IDB. Subsequently, the Industrial Programming Department of the Nacional Financiera S.A. was entrusted with the execution of a similar study on Mexico.

United Nations Headquarters also tried to promote the same type of study in other countries, the idea being that the complete set of studies would give an overall picture of the various ways in which the problem of the transfer of technology has manifested itself in the developing world, with the double objective of discovering similarities in the nature of the problems encountered and disparities attributable to particular characteristics of the countries or industrial sectors concerned. India, Israel, Mexico and Brazil were the first countries considered for such studies, the list being subsequently expanded by the addition of Argentina, Yugoslavia, the United Arab Republic, Nigeria, and Kenya. Israel was eventually eliminated because no unanimous agreement could be reached as to whether it was a developed or a developing country.

It was not possible to begin work in earnest until the second half of 1969, when the author of the present study was put in charge of the general orientation of the work in his capacity as a United Nations consultant.

Only three monographs were completed, on specific sectors of industry. Two of them (on machine tools and on the textile and clothing industries) were prepared by independent consultants, while the other (on the steel industry) was prepared in ECLA with the collaboration of several specialists. Repeated attempts were made to extend this type of analysis to other sectors, particularly the chemical, pulp and paper and food-processing industries, but all these attempts failed on account of a number of difficulties, of which, however, shortage of funds was not one, thanks to the assistance furnished by the IDB to ECLA and the United Nations.

The difficulties encountered in carrying out this series of studies were overcome partly due to the fact that the Economic and Social Planning Institute (IPEA) of the Brazilian Ministry of Planning and General Co-ordination is also engaged in analysing the role of the transfer of technology from abroad. The co-operation agreement between ECLA and the above Institute made possible frequent exchanges of opinion

/on various

on various aspects of the problem between the technical consultants of the former agency and the technicians of the latter. In the technical orientations, some substantial changes were made to the original programme of work, both as regards the interpretation of the United Nations mandate for the execution of the overall set of country studies and as regards the selection of branches of industry and the approach to the respective problems.

Thus, for instance, the inclusion of the textile industry among the sectors to be studied was not quite in keeping with the initial recommendation, which was that the sectors to be dealt with should be of relatively recent origin. The inclusion of the textile industry seemed both useful and opportune, however, precisely because of its longer standing in the country, which gave a certain historical perspective enabling better appreciation of the problems and mechanisms of technology transfer. Moreover, the longer standing of this industry in no way contravened the original mandate's recommendation that account should be taken of experience which could validly be extrapolated into the future. On the contrary, in view of the current orientation of economic policy towards greater openness to external markets and the important role that devolves upon traditional industries in such policy, it would appear to be particularly opportune to examine closely the mechanisms of technology transfer in Brazil in the broader framework of the aim of speeding up technological modernization, and recent events appear to confirm this 1/.

Although every traditional industry has its own problems deriving from its particular characteristics and the conditions of time and space in which it operates, it was considered that, in view of the impossibility of studying several of those industries, the study of the textile industry and of the results of the process of technology transfer in that industry could be of great value for orienting policies of industrial reorganization and modernization in the traditional sectors in general.

1/ We refer to the notable increase in recent years in exports of textiles and other traditional products such as clothing and footwear, to the success of government negotiations to obtain a quota in United States textile imports, and to various official initiatives aimed at facilitating and promoting the reorganization and modernization of industry, such as the Fund for the Modernization and Reorganization of Industry, at the federal level, and the tax relief fund in the State of São Paulo - measures obviously aimed at helping the longest-established branches of industry from the technological and administrative standpoint.

/As regards

As regards the approach used to evaluate the problems of the transfer of technology, some changes in the guiding principles also appeared necessary in order to reduce somewhat the attention allotted to the procedural, juridical, financial and fiscal problems involved in agreements between enterprises, while highlighting problems of industrial policy and technology. The juridical and institutional aspects vary a great deal from case to case and even within the same sector of industry, so that it is difficult to make observations and draw valid conclusions of a more or less general nature, and the information on them is moreover usually confidential and hence difficult to obtain and tabulate. It may be noted, in this connexion that without the help of the IPEA it would have been difficult to carry out the present study, even on a modest scale, in a manner in keeping with the United Nations' requirement that a detailed analysis be made.

The overall situation of the country and the general orientations of internal and external economic policy were further factors in the assignment of greater importance to problems of technology and industrial policy than to those directly related to the granting of licences. In view of the favourable external payments situation of recent years and the prospects for a continuation of this trend in the foreseeable future with overall acceleration of industrial development, accompanied by the introduction of new industrial activities involving a higher level of technology, government authorities and experts from the public and private sectors are, quite logically, more interested in elaborating effective expansion policies than in analysing the internal aspects of licensing in detail with a view to effecting savings of external funds used for the payment of royalties and other similar fees and to correcting possible fiscal anomalies, for this would necessitate the introduction of burdensome control mechanisms, more repressive than promotive, which would probably have negative effects on the strategy of expansion. This was another of the reasons for placing stress on aspects relating to the promotion of technological innovation at the expense, to some extent, of the analysis of the juridical, fiscal and financial aspects of enterprise-to-enterprise agreements for the transfer of technology from abroad.

While it proved necessary to broaden the original mandate in the manner indicated above, it also became essential to prevent the work from being transformed into a general study of industrial development in Brazil, which, if the research had not been made subject to well-defined limits, could easily have happened in view of the many factors influencing the transfer of technical know-how.

The transfer of technology is obviously closely bound up with the overall problems of industrial development. It is not possible to gain an adequate understanding of the factors that determine the process of technological modernization in developing economies without having a broad view of those economies, of their fundamental characteristics,

/their development

their development experiences and their trends and future targets. However, all this constitutes only one element of the background to the research, and not the subject of it, so that it is desirable to use already processed data in respect of these items 2/.

Having decided to take the subject in this narrower sense, it was necessary, in order to analyse the transfer of technical know-how between enterprises, to consider such already available data as the general characteristics of industry in the country, the conditions in which it develops (especially after the Second World War), the institutions for the promotion and orientation of industrial development and the growth prospects, current situation, present problems and development prospects of those sectors selected for the research project. If it had been necessary to study all these aspects, the project would have assumed unmanageable proportions or would have remained at a level of generalization that would have made it impossible to arrive at conclusions of practical usefulness. A decisive reason for the selection of industries in the study on Brazil was the possibility of making use of existing diagnoses, not only of their characteristics and economic tendencies, but also of aspects directly related to the technology currently in use and that which can reasonable be expected to be required in the next decade.

2. Some principal aspects and conclusions

(a) The transfer of technology and the problem of selection of techniques

This section will examine the main limitation on this work, as well as the central and a number of other important conclusions that can be drawn from it.

The principal limitation which stands out among many others that do not appear to require explicit justification is that the study deals with the problems of the transfer of technology without taking account (except sporadically and in an incomplete manner) of questions relating to the selection of techniques and their adaptation (in processes, products, methods, etc.) to that section of the country's industry that uses external technical know-how. Thus, the study is in the rather peculiar position of examining the nature and operating conditions of a transfer process, without extending that research to the problems connected with the nature, adaptation and effectiveness (from the point of view of private and social interests) of what is transferred.

2/ See, for example, the well-documented interpretation of the situation in Brazil in the post-war period contained in the IPEA study "A industrialização brasileira. Diagnóstico e perspectiva", a special study for the Strategic Development Programme, 1968-1970.

It is customary to distinguish three major groups of problems in respect of technology transfer, namely, the selection, the transmission, and diffusion and the absorption of imported technical know-how in the national industrial environment. The central themes of this work - avowedly not dealt with in a comprehensive manner - are the transmission (modalities, operational problems, compatibility with certain outstanding aspects of the development strategy applied) and the diffusion and absorption of the external technical know-how in the industry of the country (questions relating to the industrial structure, industrial policy, technical assistance and the systematic dissemination of technological information as an integral part of development promotion). Examination of the selection of techniques (evaluating their suitability to conditions in the country as regards such factors as size of market, etc.) is largely absent from this work, however. This question was dealt with - but only partially - in relation to the textile industry (chapter VII), in order to illustrate the content of a policy of reorganization and modernization of technology in a traditional industry, and it was also mentioned in connexion with the manufacture of machine tools (chapter VIII), in order to show the need to introduce an element of "technological forecasting" in the formulation of policies for the development of this and other engineering and electrical engineering industries. In neither of these cases, however, nor indeed throughout the study in general, was any attempt made to evaluate the extent to which the transfer of external technology was bound up with a systematic trend towards the introduction of techniques that were excessively capital-intensive in the light of the relative availability of capital and labour in the country, or otherwise unsuitable in the light of the conditions prevailing in the environment to which they were being transferred.

The fact that this particular topic was not dealt with more systematically was certainly not due to any failure to recognize its importance for the effective orientation of the process of economic and social development ^{3/}. This reduced emphasis was inevitable,

^{3/} See ECLA. "Selection of techniques and manpower absorption" (ST/ECLA/Conf.11/L.3), which deals with this topic using the Brazilian textile industry as an example of the opportunities that exist for applying programmes of internal reorganization designed to raise productivity with only modest investments. In a work presented at a conference organized by the University of Cambridge, the problem of "intermediate technologies" was considered in some detail and the author expressed a certain amount of scepticism as to the possibility of their more or less generalized use to solve the problems created by the ever-increasing capital density of modern industry (see Nuno F. de Figueiredo "Notes on Latin American Industrial Development", in Developing the Third World: The Experience of the Nineteen Sixties, compiled by Ronald Robinson Cambridge University Press, 1971, pages 106-122). See also another ECLA work, "Choice of technologies in the Latin American textile industry" (E/CN.12/746).

/however, because

however, because there neither existed nor could be elaborated an empirical basis on which even to attempt to examine the relationship between the transfer of technology, mainly through enterprise-to-enterprise agreements, and the introduction into the Brazilian economy of particularly unsuitable combinations of factors ^{4/}. There seems little point in simply analysing individual cases (specific enterprises or certain licensing agreements) as a prelude to making very broad generalizations, especially in view of the lack of generally accepted criteria on the most suitable density of capital and the presence of other factors which show that when an attempt is made to formulate or suggest economic policy conclusions, the problem proves to be really much more complex than is commonly believed. It would seem opportune, at this point, to make a few additional remarks concerning this viewpoint.

In the course of the investigation it became clear that the problem of adapting techniques is much more than a simple problem of selecting techniques on the basis of a technological and economic evaluation (as is recognized in an analytical formulation of the problem), since it depends in practice on a process of successive and reciprocal approximations between the techniques and processes transferred and the recipient environment - a process which takes time and is hard to gauge accurately in advance in view of all its possible future ramifications.

^{4/} It may be pointed out that a study of this type which tried to avoid the commonplaces so often repeated on this subject would have to be extremely complex. For reasons which it is not appropriate to discuss or even put forward here, the instruments used in government policy to stimulate industrial development (mainly various kinds of tax exemptions and credit arrangements) are designed to promote technical solutions which require a greater density of capital, thus further accentuating the trend towards increasing disparity between the private productivity and the social productivity of capital. Thus, decisions by enterprises that lead to more capital-intensive activities are entirely rational from the point of view of the (private) economic calculations of the entrepreneurs. To reorient these decisions in a direction more in line with the criteria of social profitability is an objective easily stated but extremely difficult to achieve without resorting to a complicated and hard-to-manage system of taxes and subsidies, combined in such a way as to induce entrepreneurs to decide spontaneously in favour of the solutions most in keeping with the objectives of social profitability.

/Despite this

Despite this difficulty, a number of circumstances are providing increasingly conclusive evidence that it is essential to include an element of "technological forecasting" in evaluations regarding the selection of techniques 5/. At the same time, account should be taken of the probable evolution of technology on the world plane and of the relative prices of factors on the domestic market and in industrialized countries which constitute potential export markets. Indeed, the most important thing that should be analysed is even more complex. On the domestic plane, a radical change of policy, of the kind which has occurred in Brazil in recent years and which has permitted the resumption of the development process with increasing monetary stabilization, has enhanced the importance of balanced regional development and given the lie to the myth that external imbalance was inevitable and that world markets were practically inaccessible to exports of Brazilian manufactures. Such a change of policy has enormous repercussions in the sphere of techniques and economically adequate scales of production, and constitutes one of the data that must be taken into account in estimating the possible evolution of the relative prices of factors.

At the external level, the correct interpretation of trends and the better evaluation and selection of techniques and productive processes in the orientation of domestic economic policies calls for accurate forecasting of the trends that condition changes in the internal production structure of the industrialized countries. The rapid expansion of the sectors using advanced technology and the contraction of the traditional industries in relative, and even sometimes in absolute, terms owing to the evolution of technology 6/ lead to the formation of

5/ The monograph on "The machine-tool industry in Brazil" (E/CN.12/633), which is part of the same series to which the present work belongs, includes an attempt to forecast the technological evolution of the sector at the world level and to draw certain conclusions therefrom concerning a policy for the transfer of external technology combined with an intensification of national applied research in this sector of industry.

6/ It is true that in the advanced countries various programmes of industrial reorganization are being applied in traditional sectors, such as the textile industry. Far from contradicting the trend indicated, however, this fact tends to confirm it, since these programmes represent recognition of the increasingly negative effect of the evolution of the relative prices of factors on the prices of the products of those industries and correspond to the social objective of reducing the negative effects of the decline of traditional industries on the spatial distribution of traditional activities and the employment of labour; moreover, in most cases they are restricted to facilitating or subsidizing technological change in enterprises involving the introduction of new products (of the same sector) requiring much greater density of capital but less labour.

new structures of consumption corresponding to higher levels of individual income. Moreover, changes in the relative prices of capital and labour open up real prospects for the export of manufactures by developing countries 7/.

Among the problems relating to the adaptation of techniques are those which may be called problems of the effective assimilation of techniques: a factor of great significance in differentiating the past stages of technology transfer from the present stage. When licensing agreements were as yet unknown and international trade in machinery and equipment was very limited, the effective absorption of techniques called for the simultaneous assimilation of the basic principles of the design and operation of the machinery and equipment it was desired to reproduce. This requirement inevitably led to the development of pure and applied research and technical training from the very beginning of the industrialization process. The countries of Europe in which the second wave of the Industrial Revolution took place, as well as the United States and Japan, felt this need and from the very first stages of their industrialization they gave great attention to national scientific and technological development. In any case, at that time the breach between domestic and external technology had not yet arisen: both types of technology combined naturally, and imported techniques and processes helped to promote the activities of national scientific and technological research institutions, while at the same time those techniques and processes were adapted in a creative manner, often resulting in a reversal of the transfer process in the medium and even in the short term. Thus, a recipient country became an exporter of techniques that were new, more advanced, or simply better adapted to different situations regarding productive resources and markets, that is, it developed its own versions of techniques and technological processes which it had paid to import only a few years previously 8/.

The developing countries of today are faced with a fundamentally different situation, however: they can obtain licences to manufacture products, accompanied by full and detailed designs, instructions for manufacture, detailed and precise information on the machines and raw materials that are to be used and their respective specifications; moreover in many cases, depending on the sector of industry concerned, the nature of the contract and the licensing policy followed by the

7/ A first attempt in this direction was carried out in respect of a variety of industries in Mexico by the Nacional Financiera S.A., in collaboration with the United Nations. A set of studies was prepared with a view to identifying the basic lines of the industrial evolution of the major countries of Europe and deducing conclusions therefrom that could be used in the orientation of internal policies for the promotion of production and expansion of exports (see Nacional Financiera S.A., "Promoción de exportaciones mexicanas de productos manufacturados", Mexico, 1967).

8/ See, for instance, Kankuro Kaneshige, "Recent Technological Advances in Japan", in Technological Survey 1967 (Penguin Books).

enterprise granting the license, access is also provided to any innovations which the licensing enterprise may make and to the improved techniques and processes resulting therefrom. This possibility of access, combined with the reserved market policy used to achieve industrial development on the basis of import substitution, with the consequent lack of external competition (and often even internal competition in countries with small markets), gives rise to accentuated technological inertia which leads enterprises in developing countries to depend excessively on licensing agreements and technical assistance, even in respect of insignificant innovations, since they are attracted by the ease of applying almost automatically designs and manufacturing instructions that are often supplied in the most minute detail. They thus tend to make little or no effort to get a real grasp of the basic engineering principles on which the processes and innovations in question are based with a view to modifying and better adapting them to the national environment by using the material and human resources available in the enterprise, arranging joint research programmes between various enterprises in the same sector 9/, commissioning research by official technological institutes or university laboratories, or combining these different approaches to fit the particular features of each case. An extreme example of this type of situation is obviously the case of turnkey contracts in relatively industrialized countries, where the importation of techniques, processes and human resources could and should be selective, so as to offer opportunities to national workers with advanced scientific and technological training and to use the research services, often already in existence or potentially viable, of official technological institutes and university facilities 10/.

9/ Co-operative research through "research associations" formed by enterprises which operate in the same sector and are therefore competitors has the drawback (or rather the limitation) of being effective only for the provision of more or less routine services (testing of material and products, etc.), since because of the competition between the members of the association such services are not requested (or at least not to the same extent) in connexion with more ambitious programmes aimed at investigating and developing processes or products that are new or very different from those that exist in the industry. This item has been examined in a number of studies carried out by the Organization for Economic Co-operation and Development (OECD) and also in a study by the Research Aid Foundation (FADESP) of the State of São Paulo, entitled "Política científica e tecnológica" (1970).

10/ In this connexion, see chapters IV to VI of "Subsídios para a estruturação de uma política científica e tecnológica", prepared by Nuno F. de Figueiredo for FADESP in 1970.

/It may

It may be asked at this point what is the relation between the private and social costs of, on the one hand, the technological inertia responsible for the import of technology and, on the other, the promotion of national research on innovations that enterprises need to introduce in their products or their production processes, provided that such national research is really viable in the light of the availability of human resources, laboratories and prior accumulation of scientific and technical background. In reality, there are no empirical data in existence that would enable a straightforward reply to be given to this question, but observation of the industrial panorama and numerous interviews with industrialists at which this question was raised suggest, at least, that industry in general would expect the private costs to be high. In other words, the size of the financial resources that would have to be immobilized for a protracted length of time and the substantial risk involved in such immobilization of funds would give an adverse result in a comparison with the costs involved in the procurement of the required technical know-how (including know-how of a more routine nature) through licensing agreements and other similar agreements with foreign enterprises.

It is seriously doubted, however, whether a comparison of private costs would really give these results in all or even most of the enterprises that maintain agreements with foreign firms, at least in certain branches of industry. But what matters in practice, in the short and medium term, is that the industrialist appears to think the contrary, due to a fairly understandable overestimation of the probable costs involved in national research, and acts accordingly. Since there exists an equally clear impression that the social costs of national technological research (if properly structured and selectively supported) would probably be lower than the private costs, there is full justification for the execution of some experimental and demonstration programmes promoted by enterprises and partially subsidized by public agencies; such programmes might make it possible to overcome the inertia that exists in some prominent cases and in certain sectors of industry of strategic importance, and this would have a demonstration effect for industry in general. At the same time, using these experiments as a basis, permanent machinery could be built up for future operations on a growing scale, with decreasing public subsidies, as the resistance to change and other obstacles are overcome 11/.

Thus, it is difficult to analyse the selection of techniques as though it were simply a problem of choosing between options expressed in terms of relative proportions and relative prices of factors of production, disregarding the whole vast range of connected questions

11/ See "Subsídios para a estruturação de uma política científica e tecnológica", op.cit., pages 123 to 156.

/(more difficult

(more difficult to analyse and more related to the institutional sphere and policy formulation) with which it is so intimately bound up. It would appear to be advisable, therefore, to abandon any attempt to deal with this point more thoroughly in evaluating the process of technology transfer that has taken place in Brazil over the last ten years, and this topic will be dealt with on a very limited and partial basis, solely in relation to the industrial policy on which the future policy for the transfer of external technology should be based.

(b) The transfer of technology and future industrial development

The main conclusion of this study is that the transfer of technology from abroad, which has played a fundamental role in the industrialization of Brazil during the last few decades, will maintain and even increase its influence on the technological modernization and economic progress of the country in the immediate future. Since only one of the methods of transfer of technology from outside was considered in detail (agreements between enterprises), attention was concentrated mainly on the cost of the technology transferred and its distribution among the various branches of industry and the various types of enterprise.

Leaving aside all methodological aspects and those connected with the nature and limitations of the data available, which are dealt with in the text, it seems correct to say that the transfer of technology constitutes a challenge for the future, on account of the need to formulate industrial, scientific and technological development policies more directly linked with the importation of foreign technology, rather than something that needs to be done in order to correct serious distortions which have constituted or still constitute obstacles to industrialization. The problem would appear to lie basically in the fact that developing countries are far from even having begun to exhaust all the possibilities for speeding-up industrialization (as well as promoting balanced economic and social development) by means of a suitable orientation of imports of foreign technology through agreements between enterprises and through the transmission and dissemination of technical know-how not protected by patents or trademarks. It is a matter of taking useful lessons from the past in order to formulate well-defined policies, rather than of correcting the negative side of past experience.

To begin with, the annual expenditure by Brazil on imports of external technology appears really modest when compared with that of other countries in a fairly similar stage of development, such as Mexico. Although Brazil's gross national product is twice that of Mexico, Brazil spends only slightly more than 100 million dollars annually, while Mexico spends around 200 million.

/On the

On the other hand, however, comparison with some industrialized European countries shows that the ratios of the cost of imports of technology to the gross national product are still very nearly half those recorded for Brazil over the last few years, despite the fact that Brazil obviously depends much more on imports of foreign technology. To sum up, for an average annual increase in the gross national product of approximately 9 per cent during the past few years, imports of technology have risen at the rate of slightly more than 20 per cent annually, although they have not exceeded 5 per cent of the cost of total imports of goods and services. In 1970, total expenditure on imports of technology reached 0.31 per cent of the gross national product and 0.87 per cent of the industrial product.

Well-known studies (by Solow, Dennison, Domar, etc.) have shown the importance of technological innovation in the growth of the industrial economies 12/. Others (by Bruton, Maneschi and Nunes) 13/ show that the growth of the Brazilian economy in the post-war period has also been due to a large extent to the introduction of technological innovations (estimates indicate margins of from 30 to 46 per cent as a result of technological innovations between 1947 and 1960). These estimates do not cover more recent years, but the fact that the Brazilian economy has been growing at an overall rate of around 10 per cent annually without any appreciable rise in the rate of capital formation and without any substantial levels of under-utilization of production capacity would seem to indicate an intensification of technological innovation in the process of economic growth. In view of the low level of technological activity by the enterprises themselves, official technological institutes and some Brazilian university departments (around 0.30 per cent of the gross national product), it is easy to appreciate the growing influence, in both absolute and relative terms, of technology imported through licensing agreements and other similar arrangements, and of foreign investment (insofar as this brings in technical know-how independently of agreements).

12/ See Robert Solow: "Technical progress, capital formation and economic growth", American Economic Review, May 1962, and "Technical change and the aggregate production function", Review of Economics and Statistics, August 1957 and November 1958; Edward F. Dennison: The Sources of Economic Growth in the United States and the Alternatives Before Us, C.E.D., New York, 1962, and Why Growth Rates Differ, Brookings Washington, 1967; and E. Domar and others: "Economic growth and productivity in the United States, Canada, U.K., Germany and Japan in the post-war period", Review of Economics and Statistics, February 1964.

13/ See H.J. Bruton: "Productivity growth in Latin America", American Economic Review, December 1967; also Andrea Maneschi and Egas Moniz Nunes: "Função de produção agregada e progresso tecnológico na economia brasileira", Revista de Teoria e Pesquisa Econômica, IPE (USP), April 1970.

Japan's figures for imports of technology (as a proportion of its gross national product and industrial product) show a marked similarity to those of Brazil. Both this comparison and that made earlier with some European countries seem to show that the transfer of foreign technology to Brazil is relatively modest in terms of the expenditure incurred, especially if the large extent to which the economic growth of the country depends on imports of foreign techniques and processes (inevitable in the short- and medium-term) is taken into account. The problem of the transfer of technology would seem then to lie in the inadequacy of the flow of technology from abroad (measured by the respective expenditure) in the light of the growing need for technological progress and the impossibility of fulfilling this need even by a considerable increase in locally-executed applied research and technological development work. The question then arises as to whether national industry can absorb technical know-how from abroad more rapidly than the figures quoted in the text suggest; this problem, which is associated with the problems of the structure of industry fully described in the last three chapters of this paper, calls for industrial policy and scientific and technological development measures, some of which have been proposed in specific terms.

The conclusion is thus reached that the transfer of technology requires economic policy measures closely linked with industrial policy and scientific and technological development. In their application on these different planes, these measures should follow some major guiding principles, including in particular the following:

(a) Introduction of a selective process for importing technology, established in the light of sectoral industrial strategy criteria and having the central aim of strengthening and gradually consolidating the national technological capacity.

(b) Subsequent expansion of the overall stock of imported technology during an initial period - perhaps 10 years - during which the technology of industry and other economic activities would be rapidly strengthened.

(c) Recognition that in this first stage of strengthening the technological base of industry, the index of nationality ^{14/} in many industries will probably drop, but later rise again in a more solid and permanent manner.

(d) The need to strengthen the scientific and technological infrastructure from the institutional point of view during this ten-year period of transition, before it becomes necessary to allocate resources

^{14/} I.e., the ratio of raw materials, components and productive services of Brazilian origin to the gross value of production.

on a really big scale to industrial research and to "oriented" basic research 15/.

(e) As a result of the above, the relation between the ratios imported technology/gross national product and research and development/gross national product would undergo an appreciable modification by the end of the period, although not a radical one. The radical modification reflecting a real capacity for the creation of technology would only begin to take shape from that time onwards.

It would therefore seem advisable for Brazil to reformulate its policy on the importation of technology, linking it up with an operational industrial policy of a sectoral nature, along with more rapid strengthening of the national creative capacity in applied science and technology; this would result in an increase in the overall transfer of technical know-how from abroad, with an inevitable increase in the corresponding amount of foreign exchange expenditure. There would thus be integration of the "enterprise - imported technology - national research" aspects, which would open up the way for increasing technological autonomy in the future. At this stage of greater national creative capacity - particularly as regards projects, as suggested in chapter VIII - it would be possible gradually to link up more closely other aspects of the national economic policy, such as a well-defined foreign trade strategy - especially as regards the export of manufactures, with national policies of industrial and scientific and technological development.

An estimate of the effect which this set of policies would have over a ten-year period on the ratios of technology imports and research and development to the gross national product is given in the table below. To calculate this effect, a cumulative growth rate of technology imports of 20 per cent per year was assumed, with an annual increase in national expenditure on the development of science and technology of approximately 25 per cent. It was also assumed that over the ten-year period the gross national product would increase at an average cumulative rate of 10 per cent per year in terms of constant purchasing power 16/.

15/ On the distinction between pure research and oriented basic research, see Nuno de Figueiredo, Politica Cientifica e Tecnológica, chapter II.

16/ See data for the period immediately preceding 1970 in chapter V, section 2 (a).

Year	Gross national product (index)	Imports of technology	Expenditure on research and development	Imports of technology/gross national product	Expenditure on research and development/GNP
1970	100	100	100	0.31	0.30
1975	160	247	305	0.48	0.57
1980	256	613	930	0.74	1.09

It is estimated that at the end of the ten-year period, the country would thus reach a ratio of research and development expenditure to gross national product very close to that recorded in some industrialized European countries (such as Italy) ^{17/}. The ratio of expenditure on national research and development to imports of technology would have changed from the figure of 0.9:1 recorded in the recent past to something like 1.50:1, indicating the beginning of a more pronounced predominance of national research vis-à-vis the transfer of foreign technology. From that moment, on the basis thus established, this ratio could increase more rapidly, owing to the reduction in the rate of imports of foreign technology and the more rapid growth of the amounts set aside each year by the public sector and enterprises for promoting research and technological development. This would give an opportunity for setting up an effective link between imports of technology and other aspects of a development policy, such as a strategy for the export of manufactures, which should conform to precise objectives and be based on a policy of imported technology and national technological development directed towards the same priority goals.

The author of the present study is rather sceptical about this position, and the study attempts to show that the parallel with Japan, often cited in support of this type of policy, does not seem appropriate and that in any case a link with sectoral industrial policy must first be established in order to give a more effective orientation to the process of importation of technology. Only after drawing up such a

^{17/} This proportion is from 1 to 2.5 per cent for the majority of industrialized European countries and Japan, and is over 3 per cent in the United States and the Soviet Union.

policy for the main sectors of Brazilian industry 18/ will it be reasonable to subordinate imports of technology more strictly to specific goals and aims.

(c) The main problems and difficulties met with in the transfer of technology

The foregoing does not mean that there are no problems involved in the actual process of the transfer of technology. There are in fact four main categories of problems, one general and three more specific.

In the first category, the difficulties derive in part from the relatively early stage of development of the recipient country, which limits in various ways the possibilities for national entrepreneurs to negotiate licensing and other similar agreements. They also derive from the presence in some sectors of industry of strong monopolistic or uncompetitive elements with little interest in the supply of more advanced techniques: the presence of such elements further aggravates the inferiority of a country's position in international technology negotiations. This situation has several consequences: a tendency to inflate the cost of the imported technical know-how, the insertion of restrictive clauses in the relevant contracts, and difficulty (often impossibility) of obtaining certain manufacturing licenses (for products and the utilization of processes) at all, or of obtaining them without having to allow the foreign enterprises owning the new inventions to secure majority shareholding interests.

As regards international economic relations, the official Brazilian line is to insist on the extension to this aspect of the transfer of technology of the principle - universally accepted in the trade in commodities (although its practical application is still in an incipient stage) - of non-reciprocity or of unilateral concessions on the part of the industrialized countries. The practical consequences of acceptance of this principle would of course be more limited than in the case of the trade in commodities, owing to the lack of customs and other barriers to which the principle of non-reciprocity could be applied in the transfer of technology. Since the transfer of technology takes place essentially between enterprises, Government authorities have very little influence on the conditions of contract. There are, however, two possibilities which the Brazilian authorities are exploring:

18/ To date, only the steel industry has a well-defined development programme for the next ten years. This programme sets quantitative goals, allocates the corresponding investment resources, and in addition indicates some basic options as regards production techniques and processes, scales of operation, locations, etc. Even so, it applies only to the manufacture of ordinary steels, and does not cover that of special steels.

/(a) Limiting

(a) Limiting the provisions of international law on patents and trademarks so that, while such provisions afford inventors the minimum protection needed to ensure that their rights are respected, there is no curtailment of the technical information which the developing countries need in order to evaluate and select essential techniques and processes which aid the achievement of greater national content and promote industrial development more forcefully; and

(b) Systematically organizing the international transfer of data and information on patents, including both those which are already part of the public domain but involve techniques of interest to the developing countries and those which are still valid. Some progress has recently been made in this area, but it should be borne in mind that the success of this type of measure of international co-operation depends on the concomitant establishment of national systems to receive, process and distribute the corresponding technical data, and on technical assistance and industrial extension services, likewise at the national level, to put this data within the immediate reach of the medium-sized and small entrepreneur, especially in regions of the country with less technological and entrepreneurial capacity (including the hinterland of the most industrially advanced Brazilian state, Sao Paulo). These aspects are given thorough consideration in the last chapter of this study.

The second category of difficulties standing in the way of the transfer of foreign technology by agreements between enterprises is more specific: the extremely unequal distribution of imported technology (measured by payments abroad) among the different branches of industry.

The motor industry and the industries which manufacture parts and components for it alone absorb 55.3 per cent of imports of technology; the next important industry, the steel industry, accounts for only 4.1 per cent of payments abroad for imports of technology.

The small volume of payments in respect of imports of technology in other sectors is worthy of mention, even in such sectors as pharmaceutical and medicinal products (4.1 per cent) and organic and inorganic chemicals (3.3 per cent). Payments are even less in the different branches of the mechanical engineering and electrical industries (excluding transport equipment).

The small volume of technology imported by almost all branches of industry seems much more serious than the large volume of technology absorbed by the motor industry. This latter necessarily depends to an extreme degree on techniques, processes and technical assistance from abroad, and yet despite this its financial burden in respect of imports of technology represents no more than 2 per cent of the gross value of its annual production: a figure which seems quite out of proportion in

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the light of international experience. This sectoral distribution is accompanied by an equally extremely unbalanced distribution of the average payments per transfer of technology contract in the different branches of industry.

This situation shows that in the majority of industrial activities, including capital goods but excluding means of transport, there is very little recourse to foreign technology and a greater linkage of imports of technology with the programming of the different sectors of industry, especially the mechanical engineering and electrical industries, is required. It also shows vividly the difficulties standing in the way of access to foreign technology by national enterprises, especially those of small and medium size.

The third category of difficulties lies in the distribution of the imported technology according to the ownership of the recipient enterprises. Not only do most of the licensing and other similar agreements in force involve foreign-owned firms, but average payments per contract in each branch of industry are appreciably higher in this category of enterprises. The highest levels - both as regards the number of contracts and the average payments per contract - are achieved by foreign-owned enterprises which are branches of enterprises whose parent company is located abroad, or which have financial links with the foreign enterprises providing the technology.

In such circumstances, a negative attitude is usually adopted, taking the form of proposals for much stricter regulation of imports of technology by foreign enterprises and especially by the branches of international companies. Data are adduced in support of this attitude, or simple arguments are put forward aimed at showing that this type of enterprise does not contribute sufficiently to achieving such vital national aims as the increase of exports of manufactures or the promotion of applied technological and scientific research in the country. There is, however, no reason to go along with this attitude, nor with the restrictive-type economic policy conclusions which tend to result from it even though they may not always be explicitly formulated.

There exists, first and foremost, a basic important fact which is often underestimated by these arguments, namely, the enormous and continuing expansion of the activities of international companies in the manufacturing field, especially in those branches where demand

/is most

is most dynamic and the role of scientific and technological innovations is greatest 19/.

Any attempt to play a role of any importance in the world market for exports of manufactures without taking into account and without trying to find a suitable way of using the international companies as an instrument of access into this market will inevitably lead to the formulation of goals totally lacking in viability. The experience of a growing number of countries, including some with a politically and economically socialist regime, supports this point of view, inconvenient though this may be for some ideological orthodoxies.

The assertion that international companies would not be interested in exporting nor in carrying out technological research is merely a projection into the future, rather thoughtlessly made, of tendencies observed (and then only partially) in the past, when no effective national policies for creating competition, promoting exports or establishing a favourable climate and institutional framework for national scientific and technological research existed. Thus, the behaviour of the international companies in the past was largely a logical consequence of the prevailing national policies - and in some cases the absence or rudimentary nature of such policies - within the framework of which they carried on their activities, devoted exclusively to import substitution in a very sheltered national market. With the modification of national policies, however, sometimes in conformity with changes in the international panorama which are increasingly blurring the "national" origin of these "international" companies, totally new conditions are being created in the light of which there are grounds for expecting from these international companies a growing contribution to exports of manufactures and to research and innovation, either in their own laboratories or through official or university technological institutes in the country. These prospects naturally depend to a great extent on the country concerned (size of the market, nature of the country's policies and institutions, their degree of stability, etc.) and therefore cannot be applied without taking time

19/ In 1966 the national production and international trade generated by international companies or enterprises with capital associations outside the country where they were located amounted altogether, for the non-socialist world, to approximately 40 per cent of the total gross national product of the countries in question. This percentage has increased since then, and would certainly be even higher if only manufacturing and extractive activities were taken into account (see Stefan H. Robock and Kenneth Simmonds: "International business: How big is it - the missing measurements", Columbia Journal of World Business, May-June 1970).

and space into consideration to some extent. Brazil seems to be rapidly attaining conditions which will allow it to achieve the national aims set out in the economic and social development strategy which is being applied, with the aim of securing the maximum long-term gain to be obtained from the world distribution of investments, exports, and research on the part of the international companies.

It should be remembered, as Hirschman recently observed, that the international company is a social invention which is neither good nor bad in itself, but only according to the use to which it is put 20/. The rapid transformation of world political and economic conditions in the last few years and the establishment of increasingly effective national economic policies open up very promising prospects for the use of this social invention as an instrument to promote national aims.

Lastly, but still in connexion with this third category of difficulties, it should be remembered that in Brazil the treatment of imports of technology is only one aspect, which it is impossible to deal with separately, of a much broader and important subject: the system for the treatment of foreign capital in the country. Current policy in this field has given good results, and it would be difficult to make it more restrictive with the sole aim of being able to exercise more rigorous control over the fees which international companies pay for imported technology. If the present system for foreign capital is maintained (and everything indicates that this will be so with some minor modifications), the problem of distinguishing between financial remittances and those in payment for technology, which is discussed in chapter V, will not be easy to solve (that is to say, it will be difficult to find a solution which does not lead to even more adverse consequences than the anomaly which it is wished to correct) 21/. Moreover,, although this aspect has not been specifically analysed in the present study, the significant contribution made by foreign investment in terms of new techniques of engineering, management and administration, quite independently

20/ Albert Hirschman: How to Divest from Latin America and Why, Princeton University Press, 1970.

21/ Robock and Simmonds suggest that the lack of information on the financial transactions of international companies makes policy formulation difficult in both the developing and the industrialized countries, and that this is detrimental to the international companies themselves. They propose the adoption of a universally standardized system of accounts to present this information in a systematic form.

of agreements between enterprises, should not be underestimated 22/. The problems resulting from an excessive concentration of technological imports in foreign enterprises should therefore basically be tackled by strengthening national enterprises and extending the transfer of foreign technology to them, rather than by altering the present flows of imports of technology by imposing restrictions on international enterprises. This does not, of course, eliminate the need to strengthen the institutions responsible for carrying out more effective checks (in accordance with the legislation in force) on the real need for technical assistance or for licenses to manufacture products or use processes requested in contracts submitted for approval to the Central Bank, nor does it make it any less necessary to strive to ensure that the most effective use is made of the technology paid for and imported from abroad.

The fourth and last category of difficulties to which it is desired to draw attention in this brief summary concerns the setting-up of an agency specializing in the problems of technology (see chapter VI). In view of the considerations expressed in that chapter and in chapters VII, VIII and IX, it seems advisable that the strengthening of institutions recommended by the Institute of Economic and Social Planning (IPEA) 23/, although undoubtedly necessary, should be linked more closely with the formulation and current application of an industrial policy relating both to certain aspects common to manufacturing activity as a whole and to the programming of the development of the different sectors of industry.

One of the main conclusions of this study is that the formulation, institutional establishment and effective application of a policy of transfer of technology can only take on a real meaning when they are subordinated both to an industrial policy and to a national scientific and technological development policy.

22/ For example, the ECLA study on The transfer of technical know-how in the steel industry in Brazil (E/CN.12/922), March 1972, contains data based on a detailed field study which shows that Brazilian steel enterprises in which there is majority or minority participation by foreign capital generally show a higher tendency to innovation than enterprises with wholly national capital.

23/ IPEA, A transferência de tecnologia no Brasil, Rio de Janeiro, December 1970. It may be mentioned here that this report was of the greatest value in the preparation of the present study, since it provided basic data, mainly on contracts between enterprises and payment for the transfer of technology from abroad, which it would have been difficult, if not impossible, to obtain otherwise. Hence the continual references made to this report in the course of this study.

Chapter II

CATEGORIES OF TECHNICAL KNOW-HOW IN INDUSTRIAL DEVELOPMENT

The terms technical knowledge, technology, or technical know-how are used interchangeably in this paper since it is considered that they all describe the same concept, namely the sum of applied or technical scientific knowledge that is required to establish a given industrial activity and maintain it in operation.

The inclusion in this basic category of know-how relating to economic or administrative techniques concerning the internal organization of the enterprise, side by side with engineering know-how and know-how falling in the general sphere of the exact or the experimental sciences, is to a large extent arbitrary and depends on the initial definition adopted. The proper organization and management of the enterprise in economic and financial matters and in other aspects not directly related to production engineering are, of course, of great importance to industrial development, and in some sectors of industry, such as those that have been in existence for some time in Brazil (textiles, processing of foodstuffs and other consumer goods), these factors are of paramount importance - more important even than purely technical matters relating to production processes and equipment ^{1/}. Nevertheless, such non-technological (in the strict sense) know-how does not raise the same problems with respect to transfer from abroad; as a general rule it is not subject to licensing agreements or similar arrangements between enterprises, nor does it have the same type of relationships with overall economic policy as technical know-how proper. Accordingly, it was decided in this paper to exclude techniques relating to administrative, economic and financial organization from the systematic analysis of the issue, although many references are made to them, in passing.

The technical know-how required for industrial development can be classified into a number of general categories according to whether it relates to feasibility studies, preparation of projects (i.e. investor

^{1/} See The textile industry in Latin America. II. Brazil (United Nations publication, Sales No. 64.II.G.2), and ECLA, "Algunos comentarios sobre los problemas relativos a la productividad en la industria latinoamericana" (ST/ECLA/Conf.14/L.2; LAMP-62/2) which stresses the importance of organizational aspects in industrial promotion measures.

plans of individual establishments) basic manufacturing processes, product design, construction of plant installations, and operation of industrial plants 2/.

Each of these categories can obviously be subdivided into other more specific categories in accordance with the characteristics of the branch of industry considered and the purposes of the analysis. In the present study, it is considered appropriate to examine individual types of know-how separately whenever the method of transference from abroad and the concomitant problems have features that are worthy of special mention 3/.

2/ Manuals and other documents relating to the preparation and evaluation of projects usually contain an analysis of the know-how needed for industrial development. The following are particularly useful in this respect: ECLA, Manual on economic development projects (United Nations publication, Sales No. 58.II.G.5); OECD, Manual of Industrial Project Analysis in Developing Countries (Paris, 1968), particularly the introductory chapters in volume I; ILPES, "Notas sobre la formulación de proyectos" (Santiago, Chile, 1970); Fernando Caldas and Felix Pando, Proyectos industriales (Quito); Banco do Nordeste do Brasil, Manual de localização industrial (Fortaleza); certain monographs presented at the United Nations Seminar on Industrial Projects (Prague, 1965); UNIDO, "Manual on the use of consultants in developing countries" (New York, 1960). The study prepared for ECLA by Eros Orosco, "Conocimiento técnico necesario para la industrialización de países poco desarrollados y obstáculos que se oponen a su transferencia" (ST/ECLA/Conf.23/L.12, Santiago, 1965), is worthy of note because it was one of the first studies in this field.

3/ It should be remembered, however, that any classification of this kind is inevitably arbitrary and is also influenced decisively by the specific objectives of the analysis. This latter fact is clearly evident in the three sectoral monographs which complete this series of papers on the transfer of technology in the industrial development of Brazil. While the studies on the textile and steel industries follow almost to the letter the categories given in the present paper, the study on the machine-tools industry differs appreciably (at least on the surface) from the classification not only because it covers administrative know-how, but also because it explicitly includes additional categories that do not occur in the other studies. This is attributable to the fact that the study on machine tools devoted greater attention to local know-how, which it considered a feasible and essential factor. The more comprehensive approach taken thus forms a backdrop against which the specific problems of the transfer of know-how from abroad must be viewed. A similar situation occurs to some extent with respect to the steel industry, but not with respect to the textile industry or the chemical industries.

/The technical

The technical know-how required to establish an industry, as analysed in the present study, hence corresponds to the categories described briefly below, which are used as a basis for the examination, in the chapters that follow, of the mechanisms for transferring know-how. Brief attention is also given to personnel training, which is often a factor of great importance in establishing a new industrial activity or introducing new processes into existing plant.

1. Feasibility analysis

This category covers the technical know-how required for undertaking a preliminary analysis of the economic and technical feasibility of a given industrial enterprise. The analysis usually includes studies on the productive resources to be used, the demand and geographical coverage of the markets to be satisfied by the enterprise, manufacturing techniques, investments and costs - both unit and total - corresponding to different scales of production, etc.

At this stage, the analysis generally concentrates on economic and financial aspects, which are of key importance in determining the profitability of the enterprise, rather than on technical issues, which are generally estimated in an approximate manner on the basis of general technical data that have not been prepared specifically for the enterprise concerned ^{4/}. In the light of the conclusions drawn from the feasibility analysis, the decision whether or not to initiate a complete investment project is taken. If this decision is favourable it necessitates studies of processes, raw materials (in some cases including special detailed prospecting), alternative sites, and equipment (which very often has to be specially manufactured). These studies are very expensive and are only of any use if the enterprise is actually set up.

^{4/} Such general technical data can be classified normally into two categories: real data obtained from statistical observation of existing industries (an effort being made to ensure that they are as typical as possible), and theoretical data or industrial profiles, normally obtained from simplified engineering studies and generally consisting of physical unit coefficients that can easily be converted to the monetary values of the country concerned. Information of the first type can be obtained, for example, from the UNIDO document, Manufacturing establishments, while information of the second, type can be found in the profiles included in the annex to OECD, Manual of Industrial Project Analysis in Developing Countries, and in the many studies prepared by the Industrial Development Division of ECLA on the steel, chemicals, pulp and paper, copper manufactures, aluminium refining and processing, machine-tools, boiler-making, steel tubes and cotton textiles industries. All these studies, which it would take too much space to list here, are based on engineering estimates and not on statistical data or information obtained from existing industries.

Current practices as regards feasibility studies and pre-investment analysis in the textile industry are typical of many sectors of industry in which the technology used is fairly simple, such as food processing and the processing of wood and other natural raw materials.

It is now very rare in Brazil for a large or medium-scale textile plant to be set up without a project first being formulated to analyse the technical and economic feasibility of the enterprise and define its basic technical, economic, financial and organizational structure. Virtually all the financing agencies require a feasibility study, which is prepared by firms of consultants or firms specializing in studies and projects of which there are now many in Brazil. Many of these firms are not specialists in the textile or clothing industries - or in any of the other industries mentioned - but they enlist the temporary assistance of one or more technicians who have specialized knowledge of the industry concerned. However, when a new plant is to be set up by an existing industrial group simply for the purpose of diversifying its production, the entrepreneur himself undertakes the necessary preliminary studies and takes all the decisions on the preliminary alternatives on which the final form of the project depends. In such cases the group must have a team of specialists covering a wide range of professional skills and capable of compiling and evaluating all the data, as well as of evaluating all the alternatives as regards location, selection of projects and equipment, scale of plant, etc. Even so, however, when the group wishes to seek financing or to qualify for fiscal exemptions or other development incentives - which is very often the case - it is also necessary, even with new plants belonging to industrial groups already in operation, to have a firm of consultants prepare a feasibility study. The firms of consultants used are usually Brazilian when the plans are for the establishment of new textile and clothing plants or plants producing other traditional consumer goods. Some of these firms have entered into assistance agreements with foreign firms that have a greater fund of experience, and this has enabled them to strengthen local capacity for advisory assistance and consultancy. It is, however, unusual for the textile or clothing industry to have to resort at the feasibility or pre-investment study stage to outside assistance in the form of more specialized know-how.

The above does not apply to the small isolated spinning or weaving mills which are still managing to survive despite difficulties. These are mostly small weaving mills producing short runs of a number of special items that it would not be feasible to produce in large plants even if they were very efficiently organized. There are also small spinning mills producing thick yarn for sale in small quantities to artisan-type weavers or for use in the production of cord and rope. These small enterprises usually begin by using second-hand equipment and the basis for their operations is the practical experience accumulated by the entrepreneur himself during many years of work in the textile industry as an employee. As might be expected, firms of this type use

/rather outmoded

rather outmoded techniques and completely depreciated equipment, which is in line with their objective of covering those parts of the market that are of no interest to the large plants 5/.

The most striking examples of these small enterprises are to be found in the textile industry in the Americana region of the state of São Paulo, which will be examined in detail in a later section. They are generally set up and expanded without any study being made of their technical or economic feasibility. The credit institutions either do not provide them with credit or, in the rare event that they do, they reduce their requirements regarding studies to a small amount of background information, mainly of a financial nature. Mention may be made in this connexion of an innovation which has been introduced by the Development Bank of the state of São Paulo and which consists of offering small plants substantial assistance in the preparation of the feasibility study on which the project is to be based. Indeed, in the case of the small-scale textile industry in the Americana region, the bank even goes so far as to consider the possibility of covering the cost of project preparation by private consultants working under the supervision of the Productivity Centre established by the bank in Campinas.

2. Project preparation

The preparation of a complete project should cover, in addition to a more detailed and thorough review of many of the points considered in the feasibility study (demand, resources, transport, location, etc.), two main issues: selection of production techniques and equipment, and the design of the production installations as a whole.

This first issue generally does not involve the type of technical know-how which certain firms 6/specialize in developing and marketing, especially for the continuous-process industries (chemicals, pulp, certain processed foodstuffs, etc.). In some industries, however (especially those using discontinuous processes), the selection of production techniques and processes is not separate from the design of plant installations and the specification of equipment, and such enterprises select the production processes when planning new plant.

5/ ECLA, "The transfer of technical know-how in the textile and clothing industries in Brazil" (E/CN.12/919), September 1971.

6/ Frequently, the development and the marketing of such know-how are carried out by different firms which specialize in only one of these two aspects of technological development.

(a) Selection of production processes

The selection of processes, either as a separate operation or as an integral part of the general engineering planning operations, is a key element in the proper preparation of an industrial project. Moreover, the importance of this aspect of plant installation is not confined to such manufacturing activities as the chemicals, petrochemical metallurgical, metal-transforming and electrical machinery industries which, because they are going through a period of rapid technological change, offer a wide and varied range of options. In other sectors of industry, too, even though they may be subject to less rapid change, a number of options are likewise available, and this raises the problem of selecting the right production process. The study in the present series covering the textile industry states the following in this connexion:

"There are many options open to the textile industry today as regards the choice of the production process to be included in the final project. Many new processes for combining synthetic and natural fibres have been patented. There are various new production techniques for producing similar articles or substitutes: woven or knitted fabrics, circular or longitudinal machines, non-woven fabrics, textured and non-textured yarns, etc." 7/.

The fact that a technique has been selected does not always mean that the problem of selecting equipment has therefore automatically been solved. In the continuous-process industries, such as the chemicals industries, once a given process has been chosen this almost always determines the choice of equipment. But in the industries using discontinuous processes such as the metal-transforming and textiles industries, for example, very different equipment can be used to apply the same process, so that it is the practice, after the production processes and techniques have been selected, to call in mechanical engineering experts to indicate which equipment should be used and, if necessary, to design equipment (as for example in industries using equipment made to special order) 8/.

7/ ECLA, E/CN.12/919, op. cit.

8/ It should be noted that the alternative technologies available to the continuous-process industries generally cover physical or chemical processes and are normally associated with the use of different raw materials. In the industries using discontinuous processes, however, they cover the production equipment and the successive stages of automation of equipment, which is usually a function of the degree of specialization of such equipment. Furthermore, as the flexibility of the available technological options varies in each case, the selection can only be effected on the basis of an economic analysis of costs and investment.

(b) Product design

Product design, particularly when protected by registered trademarks or manufacturing licences, is a key aspect of the know-how that has to be acquired before setting up new industrial activities. This is true for most metal-transforming activities, particularly when the product has sophisticated characteristics. In such cases, authorization to use the design is accompanied by detailed manufacturing specifications including an indication of the appropriate machinery and equipment.

In recent years, product design has become a more and more important factor and has to satisfy requirements that are often at variance with the fact that design know-how is of foreign origin. Thus, export promotion policy increases the need for originality in product design, while, it has been found in practice that modifications made to simplify product design in order to cut manufacturing costs have sometimes been of decisive importance.

(c) Design of industrial plant

The plan for the production facilities as a whole includes the detailed design of the factory and hence covers civil engineering, siting of machinery and equipment, establishment of flow patterns for the movement of materials, and design of ancillary installations (electric power, water, steam, transport links, etc.).

Another important aspect, directly related to production equipment, which is sometimes included in project preparation and sometimes dealt with separately concerns the selection of suppliers, the placing of orders, and the inspection and control of deliveries.

The project for an industrial plant is frequently more than just an enumeration of the various types of special know-how mentioned (civil engineering and building, ancillary services, siting of machinery and equipment, establishment of flow patterns for the movement of materials and products, etc.) in which each in isolation is not of great importance and is almost always entrusted to a sub-contractor. Taken together, these aspects represent a specific and very important form of technical know-how, namely, the overall scaling and proper balancing of the different categories of operations making up the industrial activity, and this technical know-how is usually the explicit complement of the design of the industrial facilities.

3. Construction of the factory

The construction of a factory is not a simple task of civil engineering, since it also includes the installation of equipment and the solution of a great many problems regarding size and internal balance which are vitally important if it is to operate efficiently. Such

/problems, as

problems, as for example those found in the steel industry which are examined in detail in a separate study 9/, arise only in the construction stage and cannot be foreseen during the preparation of the project.

In other words, in large-scale enterprises (particularly primary metallurgy, both ferrous and non-ferrous, and petrochemicals) this stage of construction and assembly, which strictly speaking forms part of the project, in practice represents an extension of the preparation and, more especially, the review of the project. This is because in highly complex projects of this kind it is virtually impossible to reach such a degree of detail as to be able to foresee all the problems and difficulties that may arise in the construction stage. Thus the project is gradually adapted during this stage, as progress is made in its practical execution.

The problems which tend to arise in the case of steelmaking are connected with adjustments to the general layout of the installations, the balance between all the internal flows of materials, products and power 10/, and the synchronizing of the completion of the various production installations and their entry into operation.

For this reason, when large plants are built it is quite usual to contract for the general supervision of the construction separately from the physical construction, as an extension of the stage represented by the final project.

However, it is not only in highly capital-intensive industries that problems arise during the construction of the installations. Here again, the textile industry can be taken as representative of a wide range of activities of simple or only moderately complex technology. The technical know-how used in this branch of industry is almost exclusively of local origin, both as regards plant design - which includes civil engineering, auxiliary installations and the layout of equipment - and actual construction. This know-how is contributed partly by the local entrepreneur (who instructs the specialized companies responsible for the design and construction regarding the characteristics of the architectural project and the industrial activity to be installed) and partly by civil engineering and industrial assembly enterprises, which are nearly always Brazilian. However, there are two instances in the

9/ See "The transfer of technical know-how in the steel industry in Brazil", op. cit.

10/ It is particularly difficult to achieve this theoretical balance in the project stage and it is even difficult in the construction stage, since the various types of equipment have different characteristics with regard to performance which cannot be known in detail until after the specifications are issued, the bids called for and approved, the manufacturers known, and precise and detailed information regarding the relevant performance obtained. Moreover, the actual performance always differs to a greater or lesser degree from the rated performance (Ibid.).

design and construction of a plant where technical know-how is still imported from abroad. The first relates to the advisory assistance required by the architect-engineer responsible for preparing the plans in regard to the movement of personnel; the internal transport of materials and finished products; ventilation, temperature, humidity and lighting conditions in the various sections; minimum free space, and many other kinds of information which come within the competence of a textile specialist and which can be provided only by firms with wide experience in the matter.

Since advisory services of this kind are still somewhat inadequate in Brazil, these services are sometimes contracted abroad, either through a technical assistance agreement with a firm of textile consultants or through the direct recruitment by the local entrepreneur of a highly qualified technical expert for a limited period.

The second instance relates to a vital part of the construction of a plant, i.e., the assembly and adjustment of the equipment.

"The assembly and adjustment of equipment is always the responsibility of the specialized staff of the machine manufacturer, who charges separately for their services. Here there is a substantial transfer of know-how from those who are installing the plant to the local staff who help them to do it. If the local staff have been selected well, they will accumulate a detailed knowledge of the construction and operation of the machines during assembly which will be valuable for subsequent adjustment and maintenance. Neglect of this opportunity for training staff, which does not involve any extra cost, has led to serious losses for many factories, whose machines often break down or lose their efficiency owing to faulty adjustments" 11/.

In other sectors of industry - especially in small- and medium-scale enterprises - problems arise owing to technical faults in the stage of the construction of the plant and the installation of the equipment. These problems could be solved in part if the analysis of projects by financing agencies were not confined to financial aspects but included a detailed appraisal of the technological aspects of the enterprises. Such a procedure, which would gradually result in the provision of a certain amount of technical assistance by financing and development promotion agencies, would be especially useful in those branches of industry in which many small- and medium-scale plants still exist. The pulp and paper industry is a case in point. The lack of technical assistance is felt in small plants right from the stage of assembling the equipment, which many entrepreneurs undertake themselves in order to save on this item of their investment programme. In so doing they introduce into their plants structural errors which have continuing adverse effects on their operations. In such cases, a large part of the

11/ ECLA, "The transfer of technical know-how in the textile and clothing industries in Brazil", op. cit.

blame may be laid on development financing agencies which fail to give due importance to the analysis of the assembly and engineering side of the projects, thus indirectly encouraging this superficial "saving" whose harmful effects are perpetuated in the structures of the manufacturing units installed 12/.

4. Operational know-how

Technical know-how relating specifically to the operation of an industrial enterprise is of basic importance in the more complex industries where the manufacturing process consists of operations which are not merely repeated over and over again in exactly the same way, but require constant intervention according to varying technical circumstances.

The three sectors of industry studied from the standpoint of the transfer of technology present very different characteristics in this respect.

In steelmaking, operational technology is a vitally important factor throughout the life of the enterprise, which thus has to have frequent recourse to foreign assistance for a long time after the start of operations.

Although in the machine-tools industry technical know-how continues to be of great importance, it is essentially repetitive and does not need to be imported.

In the textile industry, the manufacturer supplying the equipment accepts responsibility for handing over the plant in perfect working order with a pre-established level of production for each machine, which is verified by means of tests. Thus, before the start of regular operations, tests are carried out to make sure that the actual performance of the equipment is that indicated by the suppliers. With these tests the manufacturer fulfils his commitment to deliver the equipment operating at a pre-established level of efficiency and to transmit the specific know-how on the adjustment and maintenance of the machines to the local technical staff 13/.

12/ See Relatório da pesquisa sobre a estrutura brasileira de produção e consumo de celulose e papel, Leone e Associados, Rio de Janeiro, 1968, page 208. This study points out that there is a typical vicious circle in that the "technology" used in small paper plants is generally reduced to the basic characteristics of the machinery purchased. If his investment possibilities do not permit him to supplement his production machinery with other equipment (particularly that intended to reduce costs rather than increase production), the small manufacturer remains a prisoner of the inadequate equipment originally installed, and must operate at costs which prevent him from increasing his capital in order to rationalize his production facilities.

13/ "The transfer of technical know-how in the textile and clothing industries in Brazil", op. cit.

5. Personnel training

Although normally personnel training should be separate from the installation of individual enterprises and should follow the same lines in a whole sector of industry, in practice - especially in the initial stages of an industrialization process (as, for example in the North-East of Brazil) - a different procedure may have to be adopted. When an enterprise is the first of its kind in a particular area, it may be necessary to establish a training programme to meet the specific needs of that enterprise in terms of skilled personnel. In many cases, therefore, technical know-how must be imported through training, either by sending personnel for training abroad or by organizing their training in the country concerned with the help of foreign technical experts. Both these systems were used in Brazil's industrial development during the post-war period and are still frequently used. In the more advanced South-Central area, however, there is an increasing trend to replace external by local elements in training activities.

The training of the personnel directly in charge of the more technologically advanced equipment is always a key point in an efficient industry, even in such a well-established branch as the textile industry. In fact, it is the second crucial stage in the transfer of technology in this branch of activity, the first equally critical stage being the assembly of the equipment, in which, as noted previously, the local staff who assist in the assembly operations carried out by technical experts sent by the suppliers initiate their training.

After the transfer of "know-how on the performance, running, adjustment and maintenance of the equipment", which constitutes the assembly stage, comes the testing phase prior to the start of operations, in which such knowledge is deepened and broadened and the local staff learn the special features of the processing of the raw material with the machinery installed. "This is one of the most important phases in the transfer of know-how when new factories are being set up, and the alert machine manufacturer will devote sufficient time and effort to this task to be sure that his machines are left in the hands of competent staff; otherwise his reputation as a manufacturer would suffer" 14/.

Machine purchasers and users do not always have quite the right attitude, however, and it frequently happens, especially among medium-scale industries and among entrepreneurs having experience in trading in textiles rather than sound experience in manufacturing, that proper care is not taken in the assembly and pre-production testing phases.

It is wrongly assumed, in these cases that, the rated performance indicated by the manufacturer will either be attained easily and almost automatically without any special effort of adaptation, or that it will at any rate be attained quite rapidly as the local staff gains experience

14/ Ibid.

after the tests prior to the start of operations have been completed. Consequently, the local manufacturer fails to pay proper attention to this crucial phase in the transfer of know-how from abroad, and this has various adverse repercussions, the most important being the failure to engage sufficient properly qualified local technical staff to participate fully in the assembly work and tests prior to the start of operations. This is one of the main obstacles to the efficient transfer of technology from abroad in the textile industry.

A fair amount of training of local staff takes place, albeit spontaneously during the assembly and pre-testing phases. "However, staff training cannot be limited to this transfer of know-how by the manufacturer; on the contrary, it must take the form of a regular programme of in-service training, both during the installation of the plant and during its normal operation."

"This programme provides for on-the-job training during normal working hours, using instructors who have regular jobs in the enterprise, and for sending staff from the factory to training centres or to the workshops of the machine manufacturers. In fairly large factories with an energetic administration, it is common for some high-level technicians to be sent to gain practical experience in factories abroad. The transfer of know-how thus obtained is remunerative and relatively cheap when the staff are selected properly. However, the staff to be sent abroad are not always rationally selected. In fact, it often happens in private companies and family concerns that staff who do not have the necessary experience and technical background are selected and sent abroad supposedly for training, returning afterwards to become technical managers of their firms. In such cases, there is no transfer of know-how, since the staff chosen do not have the minimum qualifications to assimilate it."^{15/}

6. Other aspects of industrial operation

It is worthwhile making some observations concerning quality control and the preventive maintenance of machines. The technical know-how relating to these two activities plays such an important role in the textile industry that in the study on this sector they are dealt with separately from the general know-how relating to the normal operation of the plant. The same also applies to other sectors of industry where the capital-intensity is rising fairly sharply and the number of working shifts is therefore having to be increased.

The methods used in the textile industry controlling the quality of raw materials, intermediate products and finished products and for the preventive maintenance of machinery and equipment are usually inadequate and constitute another unsatisfactory item of some significance as regards the process of importing technology. Even when new plants

^{15/} Ibid.

are established - except in the case of large-scale enterprises belonging to groups with a long tradition and wide experience in the sector - insufficient attention is paid to these activities, not only for want of quality control equipment but also because the staff lacks the necessary knowledge to operate such equipment and interpret its results.

Lastly, very few plants have a programme for the preventive maintenance of their equipment based on the machine manufacturers' instructions on the behaviour of the various units and the minimum requirements as regards cleanliness, lubrication and adjustment. In addition to detracting from the overall efficiency of the installations, the lack of preventive maintenance programmes constitutes an almost insurmountable obstacle to the introduction of a continuous system of working, with three eight-hour shifts a day. This rate of utilization is essential if the introduction of more capital-intensive equipment in Brazil's textile industry is to be economically justified 16/.

7. General considerations

The technical know-how described above may be grouped in four main categories: analysis of feasibility or preparation of the preliminary project, preparation of the final project including the engineering project, construction and assembly, and start of operations.

There is, however, a very important earlier stage, particularly in the preparation of projects by public bodies, in which there have also been certain forms of transfer of know-how from outside Brazil. This is the preliminary selection stage which entails the carrying out of a number of sectoral or regional analyses, somewhere between the macroeconomic analysis and the project itself, or of preliminary multidisciplinary studies on specific problems such as training, technological research or transport. These studies are intended merely as a frame of reference for continuing the pre-investment activities with a more specific orientation or, in other cases, for obtaining subsidies of a relatively general nature for defining policies or organizing the structure of institutions.

From the industrial development point of view, the most important categories in which there is most need for collaboration from abroad, are the selection of processes (process engineering) and the plant design (project engineering).

16/ Up to a short time ago, by a decision of the Industrial Development Committee of the Ministry of Industry and Trade, it was forbidden to set up new plants or reorganize existing ones so as to increase their production capacity. This restriction was lifted in May 1971.

The subdivision into independent categories clearly depends on whether the industries concerned are continuous-process industries such as chemicals, cement, pulp and paper, or discontinuous process industries such as metal-transforming and textiles.

In the chemical industries, the selection of processes is the crucial step in the establishment of a new plant. In the metal-transforming industries, however, where the processes are less varied and are necessarily continuously repeated in the different production lines, the choice and size of the production equipment is more important and forms an integral part of the preparation of the project.

In process engineering for the chemical industries it is sometimes necessary to deal separately with the know-how on the basic processes and that on the equipment for applying those processes. The first type of know-how relates to the technical data and details concerning the nature and characteristics of the chemical reactions applicable in the manufacturing process, while the second concerns the determination of the size of the equipment and the specifications of the machines and materials required for the industrial application of the chemical processes.

According to Professor Politzer 17/, a large part of the technical know-how on chemical engineering is provided by the manufacturers of the equipment and materials, so that it is only necessary to have decided upon the processes to be used, in order to be able to specify and order the appropriate equipment and materials. Only when highly specialized practical knowledge is required, because the equipment must operate under special conditions (extremes of temperature or pressure, chemically reactive atmosphere which is highly detrimental to construction materials, etc.), is it necessary to obtain original technical know-how, which is often outside the scope of the equipment manufacturers. However, the collaboration of these manufacturers is always an important source of the technology required for the establishment of new units in the chemical industry.

17/ Kurt Politzer, "O nível técnico e as modalidades de transferência de conhecimento técnico do exterior na indústria química do Brasil" (ECLA, 1966).

Chapter III

WAYS IN WHICH TECHNICAL KNOW-HOW IS TRANSFERRED FROM ABROAD

1. Methods of transfer

The technical know-how required for industrial development, which comes under the general categories enumerated in the previous chapter, is either freely available, when it belongs to the stock of know-how which forms part of the public domain and is hence easily accessible through books and technical publications, enquiries to national or international bodies, visits to enterprises, etc., or else it is not freely accessible, regardless of whether it is protected by trademarks and patents or not, because it is under the control of enterprises and other bodies which only make it available, in exchange for financial remuneration, through licensing agreements or contracts for the provision of technical services.

(a) To begin with, let us consider some aspects connected with the technical know-how which is part of the general patrimony of the human race and which is so important for the creation of a high general level of technology. This technical know-how is transferred through the numerous channels by which knowledge and information are disseminated to the world: general and technical information media; the movement of persons, with the consequent interchange of experience, and, lastly, specialized university, technical or professional education, which channels in a systematic and orderly manner the stock of technical know-how freely available in the developed world.

Although it belongs to the public domain, however, this type of technical know-how does not always have an unobstructed flow. In fact, with the increasing complexity of science and technology, there is an ever-increasing need for organized and systematic work (hence with some degree of centralization) to ensure effective access to this know-how and its rapid dissemination in the scientific, technological and industrial fields in each country. It should also be borne in mind that in the more industrialized areas a great deal of more specific technical know-how relating to concrete applications in industry is likewise public property because of the expiry patents and the existence of industrial experience which, by its very nature, cannot be legally protected.

In both cases, however, institutional differences and industrial and technological inequalities are obstacles to this theoretical freedom of access. To complete this summary of the aspects which make it necessary that a national scientific and technological information service or services be set up, it may be mentioned that the dissemination in brief summary form of processes patented abroad would help enterprises - especially the smallest ones which have no links

/with foreign

with foreign countries - to find the most appropriate sources from which technology could be imported through enterprise-to-enterprise contracts.

(b) Secondly, when the technical know-how necessary for the industrial development of the country involves products or processes which are under patent, or products and processes which, although not legally protected by a registered trademark or patent, are complex and closely linked with the practical experience of specific foreign enterprises, such know-how can only be obtained by means of agreements or contracts with those enterprises.

The agreements generally known as licensing agreements are in fact very varied and difficult to bring under any general definition. It is however possible to distinguish two main categories: those granting rights in respect of patents on products or processes or authorizing the utilization of registered trademarks, with or without technical assistance in respect of non-patented aspects, and those which merely provide for the supply of various technical services or technical assistance without granting patent or trademark rights. In Brazil, both types of agreements or contracts have to be approved by the authorities. The legal and financial details of the agreements vary very considerably, however, depending on whether the utilization of patent or trademark rights is involved.

(c) Foreign investment is usually accompanied by a technological contribution - of decisive importance in some branches of industry - which takes the form of new production techniques, the introduction of new products, and the modernization of methods of organization and management, thus constituting an extremely important form of transfer of technology from abroad, especially at the present stage of industrial development in Brazil, where the size of the market and the increasingly accurate and stable determination of economic policies is leading foreign enterprises to undertake more dynamic and technologically advanced activity in their investment and production programmes. Often, however, the technological contribution of foreign enterprises is largely the subject matter of agreements on the transfer of technology which are separate from financial investment as such. Foreign investment cannot therefore be considered as offering a technology transfer method which is a preferable alternative to licensing or technical assistance agreements. Where there are no concrete agreements on the transfer of technology, it is extremely difficult to make a reasonably objective appreciation of the contribution of technical, organizational or commercial know-how concerned; such an appreciation would require a detailed review of the economic, financial and legal aspects of the foreign investment. From the point of view of the transfer of technology, then, foreign investment will only be considered here, in an analysis of the agreements in force in Brazil in terms of the ownership of enterprises (chapters V and VI), when it is combined with licensing or technical assistance agreements. As will be seen, it is the foreign enterprises which have most recourse to licensing or technical assistance agreements.

/(d) Contracts

(d) Contracts and agreements between enterprises are of different types, and the technical know-how is transmitted in many different forms. In some cases, it is transmitted through documents supplied by the enterprise or body providing the technological know-how (plans, designs and manufacturing instructions for products, equipment layouts, flowsheets, specifications of equipment, etc.); in other cases the supplier enterprise sends technical staff to take over certain specific jobs temporarily, while often the transfer of technical know-how between enterprises uses more than one channel at a time, and the agreements between them provide for various different types of collaboration.

It is worth mentioning that many licensing agreements only authorize the use of a trademark or a particular patented process, without accompanying this authorization with any instructions, documentation or technical assistance. In such cases, this assistance is obtained separately from another enterprise or consultant firm. Agreements for the transfer of specific technical know-how may be made with foreign enterprises or foreign organizations which are engaged exclusively in developing technology and do not actually carry on any manufacturing activity themselves. Both cases are frequent in practice.

(e) Although there is no hard and fast correlation between the particular characteristics of agreements between enterprises and the main categories of technical know-how needed for industrial development which were listed in the previous chapter, some general comments are in order.

Agreements between enterprises in the same branch of industry generally concern product engineering (designs and specifications for its manufacture), and sometimes also the use of a patent or trademark. It is also usual to obtain the process specifications and the technical know-how connected with the operation of the factory by this means.

Technical know-how on processes in continuous-process industries and know-how on the associated factory design and construction is usually supplied by firms specialized in the provision of technological know-how (consultant firms). In many of these industries (especially the petrochemicals industry) the technology for running the factory comes from the consultant firm as well as the know-how on the selection of processes and the design and construction of the factory.

2. Licensing agreements

Licensing agreements may be drawn up between enterprises in the same or in different countries. In the latter case, the legal, economic, and financial aspects are naturally more complex. Although the present document does not pretend to analyse these agreements from a legal viewpoint, nor to make a complete study of their characteristics or of the general problems arising from their application, it seems appropriate, by way of introduction, to discuss some general aspects not directly connected with Brazil. Since licensing agreements are essentially the result of negotiations between an enterprise established in one country and another enterprise located abroad, international practice and, in some cases, the rules on patents set forth in international treaties and conventions play a fundamental role ^{1/}.

To begin with, let us see what can be the subject of licensing agreements, according to international practice:

(a) Patents. The most common subject of a licensing agreement is a patent. The owner of the patent usually grants some natural person or enterprise the right, exclusive or otherwise, of using or selling the products or processes patented. As the protection conferred by a patent is limited to the territory of the country issuing it or registering it, patents must be registered in other countries too in order to secure legal protection and thus to be able to grant licenses in those countries.

Licenses in respect of patents take various forms. They may authorize the manufacture or sale of products by the licensee; manufacture by the licensee so that the owner of the patent may use or sell the products; a leasing agreement, or even merely a license to distribute or sell the products concerned. The license may also cover the assembly of parts of a patented product: this formula is frequently used in the automobile and electrical industries. In the chemical, pharmaceutical and foodstuffs industries, on the other hand, licenses frequently cover the bottling, packing or canning of patented products. Finally, there are many instances of agreements combining different forms of licenses.

(b) Technical know-how. Another type of license of growing importance is that granting technical know-how. In order to enable to manufacture products or apply patented processes properly, especially when the licensee enterprise is not on the same level as

^{1/} On international practices in this context and on the rules applied under the national legislation of several countries (not including Brazil), see Götz M. Pollzien and George B. Bronfen (editors): International Licensing Agreements, Bobbs-Merrill Co., New York, 1965.

the enterprise granting the know-how, the data and technical instructions belonging to the latter, which include formulae, manufacturing instructions, etc., are needed. In these cases it is necessary to obtain not only the license for the patented product, but also the technical know-how needed to manufacture or utilize it. This manufacturing know-how is not always issued by the same enterprise which issues the license to use the process or manufacture the product, however. As a result of the rapid technological growth of many sectors - especially the chemical industry - two marked tendencies have emerged: specialization by firms which concern themselves solely with granting patent, and specialization by firms which only issue technical know-how (either for the actual application of patented processes licensed by other firms or for what is termed "production engineering" for manufacturing purposes).

(c) Inventions. These may be the subject of licensing agreements regardless of whether they are patented or not. "In some European countries the invention is considered to be as important as the patent which may be obtained for the invention, the reason being that a patent application may be denied or, if the patent will be issued, it may be nullified at a later date. Therefore licensees in these countries will usually insist upon securing a license of the invention together with the patent protecting the invention."^{2/} It has not been possible to check how far this practice is followed in Brazil.

(d) Trademarks. Registered trademarks are also the subject of licensing agreements. Once a trademark has been registered in a foreign country, the right to use it is normally granted in combination with parallel manufacturing agreements providing for the transfer of patents or the supplying of technical assistance in connexion with the industrial operations. Agreements licensing the manufacture of patented products or the use of patented processes, with the automatic right to use a trademark without the need for any further agreement, are also frequent. The legislation in force in Brazil regarding licensing agreements will be considered in chapter IV, but it may be mentioned already at this point that the law does not allow the registration in the Central Bank of licensing agreements in respect of the use of trademarks or patented products or processes concluded between the Brazilian branches of foreign enterprises and their parent firms abroad ^{3/}.

(e) Others. Mention may be made of licensing agreements in respect of copyright, which must be previously registered in the countries where it is desired to grant the licenses. Finally, there are many cases of combinations of the various types of licensing agreements already mentioned.

^{2/} See Pollzien and Bronfen, ibid. pp. 10 and 11.

^{3/} The international registration of trademarks is a complex subject which is outside the scope of the present work. See, for example, Eric D. Offner, International trademark protection, New York, Fielston Press, 1965.

The basic provisions which are usually found in international licensing agreements ^{4/} are:

(a) Preamble: It is considered appropriate to express clearly from the beginning the original intentions of the contracting parties and the situation of the patented product or process as far as its legal status in both the country of the licensor and that of the licensee is concerned.

(b) Subject of the license. It is necessary to describe the subject of the licensing agreement as accurately and in as much detail as possible, and to establish clearly the nature and scope of the rights granted (for example, if they are granted exclusively, and if the licensee may grant sub-licenses to other enterprises).

(c) Rights and duties. Those of both the contracting parties should be described in detail. For the licensor, the most important provision is the right to receive royalties, calculated as a percentage of the value of production (or sales), sometimes combined with an initial payment, and having a certain minimum absolute value, or else taking the form of a single lump-sum payment. Generally speaking, when no initial payment is provided for, this is compensated by raising the percentage of the royalty. It is also common to make it a duty of the licensee to spend a certain minimum amount on advertising in order to promote the opening and expansion of the market for the product in respect of which the license is granted. International experience indicates that the value of the royalty may fluctuate between wide limits, but a royalty of more than 5 per cent of the value of sales is considered uncommon ^{5/}. It is also frequently stipulated that the amounts payable annually for royalties should be converted into shares in the licensee enterprise; this formula is often welcomed by financially small or medium-sized licensor companies, as a desirable alternative to direct investment (through the opening of a branch or a joint enterprise with a local group) in the country to which the license is granted. Chapter IV describes Brazilian practice in this matter.

^{4/} Pollzien and Bronfen, op.cit., p. 14 et seq.

^{5/} This does not mean that it is not common to find agreements providing for much higher royalties, sometimes accompanied by excessive initial payments, between the enterprises of industrialized countries granting licenses and licensee enterprises in developing countries (see for example Simon Teitel: Notes on the transfer and adaptation of technology in Latin America, with special reference to industrial development, IDB, Washington, June 1971; this study (p.18) cites the case of a licensing agreement with an initial payment equivalent to 15 per cent of the share capital, plus the payment of the royalties varying, according to the product, from 3.5 to 5 per cent of sales).

For the licensee, the most important factor, in cases where technical assistance is provided (with or without patents), is that he should receive adequate guidance, in the form of technical data and other information and instructions, to allow the technology purchased by him to be effectively applied in industry. In cases where all that is granted is the right to use patents, the licensor has a basic obligation to use all the commercial and legal means at his disposal to maintain the patents in force, so that legal action can be taken against any infringements which may occur. Lack of attention to this point would give the licensee the right to cancel the agreement, and a cause to this effect is sometimes expressly included in the agreements.

(d) Guarantees. A very important aspect is that of the guarantees of performance or output which the licensor gives in the case of equipment of complex construction or operation. These guarantees would appear to be common in agreements with United States firms and concern "certain minimum performance characteristics such as daily output, life of critical parts, etc. If these minima are not met prior to a specified date the royalties may be reduced according to a predetermined formula. Of course, in such cases the licensor should reserve to himself an appropriate degree of control over the design and installation of the plant and over the conduct of the performance tests. The licensee also should realize that in such situations the licensor must protect himself by overdesigning the critical features with the result that the net cost of the plant to the licensee may be increased far in excess of any penalties he is likely to recover under the guarantee or of losses he would be likely to suffer in the event of less than perfect performance in the absence of a guarantee" 6/. This is a matter which often gives rise to difficulties in licensing agreements drawn up with enterprises in developing countries, since it is noted that in practice the licensor

6/ Pollzien and Bronfen, op.cit., p. 325.

/enterprises are

enterprises are unwilling to include guarantee clauses, or only accept them under extremely onerous financial conditions 7/.

(e) Other provisions. These are concerned with payments (rates of exchange, income tax paid by the licensee or licensor) 8/, improvements

7/ This topic was dealt with in an ECLA seminar on the development of chemical industries in Latin America, the final report of which gave some points of view which, because of their lack of identity, illustrate the difficulties of the problem. According to the report, one participant particularly well versed in this type of problem stated that the remuneration received by an engineering firm for services provided in the preparation of a project for a major industrial installation was not sufficient to allow it to cover the cost of the alterations which it might be necessary to make in the installations for operational purposes, nor could such firms accept responsibility for loss of profits suffered by industrialists during the initial stage of operations. The only guarantee possible, the participant went on to say, was the selection of a firm with a good technical reputation and a reputation for reliability, and that should in any case be normal procedure. Another participant, the report went on to say, stated that the procedures followed by the firms which normally granted licenses for the use of processes and provided technical assistance varied in that respect. An example was given of one such firm - an organization devoted exclusively to the development of new processes and their licensing - which assumed a definite responsibility up to a specific value in the standard contracts drawn up. A substantial part of the remuneration received went to cover costs which were necessarily incurred until the time when the installations were in full operation according to the terms of the contract (see ECLA: Informe del Seminario sobre el Desarrollo de las Industrias Químicas en América Latina (E/CN.12/719/Rev.1), Caracas, December 1964).

8/ There are numerous international seminars and conferences which have dealt with this topic and recommended different measures of international co-operation aimed at reducing the cost of the technology imported by developing countries. For example, the first interregional conference on the development of petrochemical industries in the developing countries, held under the auspices of the United Nations in Teheran in November 1964, suggested that developed countries should grant exemption from income tax or proportionately reduce the amount of tax in respect of royalties received by companies for licenses granted to developing countries. Moreover, the practice predominating in the majority of the licensing agreements registered in Brazil is that the licensor has to pay income tax on remittances of royalties abroad, and as the licensing enterprise also has to pay tax on the sums thus received in its own country, this is a form of double taxation.

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in the product or the licensed processes (frequently through the exchange of experience between the contracting parties), possible innovations in the licensed products or processes (which may or may not form part of the rights granted under the license), the duration of the agreement and the possibility of early termination under certain circumstances, and lastly, procedures for settling doubts about the interpretation of the terms of the agreement (arbitration). In a sense, the system known as cross-licensing in Europe and the United States, represents an extension of provisions for the granting by the licensee to the licensor of the improvements made by the former to the licensed product or process. Under this system, both enterprises grant mutual rights for the use of patents, thus making both of them licensees and licensors at the same time. This system may or may not include an exclusivity clause, and it may concern both existing patents and patents that may be registered in the future.

3. Industrial property

The practice of licensing agreements is based, as we have seen, on the right to register trademarks and patents. In Brazil this right is regulated by the Industrial Property Code, established under decree-law 254 of 28 February 1967, which amended the previous legislation 9/ and is currently the subject of studies and consultations with the representative bodies of industry, with a view to introducing further amendments. In the sphere of international co-operation it is governed by the Paris Convention of 1884, to which Brazil and 64 other countries acceded and, as regards the supplementary aspects of that Convention, by the Treaty on international co-operation in the field of patents which was approved in Washington in May 1970.

8/ (cont'd) This could be avoided, between countries which have double taxation agreements, if the tax paid in the licensee's country were credited to the licensor enterprise for tax purposes. Lastly, it may be noted that when the payment of income tax on the remittances of royalties goes on the account of the licensee enterprise, this imbalances the situation regarding the cost of technical know-how for an enterprise of the same nationality as the licensor firm, and for the Latin American enterprise, even when both have contracts which are similar in all other respects. In Brazil, this difference would amount to approximately 25 per cent of the cost of the technical know-how.

9/ Decree-law 7903 of 1945, as amended in 1945 and 1961.

The main provisions of the national industrial property code currently in force do not differ widely from the legal practices followed in other countries 10/.

Patents are valid for twenty years from the date of issue. The processes for the manufacture of chemical and medicinal products are patentable, but not the products themselves, i.e., the types of medicaments and products that are obtained by chemical means or processes 11/. Applications for the granting of patents are examined from the legal and technical aspects, that is, as regards the novelty of the invention and the possibility of its application in industry. The issue of licenses may be compulsory after two years, if the patent has not been worked or if its use has been interrupted for more than one year. However, this has not occurred in practice. There is also provision for the revocation of patents that have not been worked for three consecutive years, the importation of products that include the innovation protected by the patent being considered no impediment to such revocation. Under the terms of the Paris Convention, patents will not be granted in Brazil when, during the previous twelve months, a similar patent has been granted or applied for in another country signatory to the Convention (reciprocal provision).

There are two important comments to be made regarding the Brazilian system of industrial property briefly described above. The first concerns the unconditional acceptance of the principle of reciprocity with the industrialized countries embodied in the Paris Convention, which it was attempted to consolidate and even extend through the treaty on patents recently studied in Washington. The second concerns the internal functioning of the system, especially as regards the publication of registered patents and the orientation of that publication with a view to stimulating national invention and technological research.

10 / For an analysis of the main provisions of the industrial property legislation of various countries, including Brazil, see United Nations, The role of patents in the transfer of technology to developing countries (New York, 1964). For a more highly summarized comparison see also Stacy V. Jones, The Inventor's Patent Handbook (New York, 1966), annex B. In addition, Pollzien and Bronfen (op.cit.) make a detailed assessment of the industrial property legislation of several countries (not including Brazil) as it affects licensing agreements.

11/ This is an important aspect of the system of industrial property in many countries. It should be noted that Italian legislation considers neither the products nor the processes of the pharmaceutical industry to be patentable, although bills to modify this system have been tabled in parliament (Pollzien and Bronfen, op.cit., page 179), and this has been adduced as the reason for the thriving state of the pharmaceutical industry in Italy (Constantine V. Vaitzos, Patents revisited; their function in developing countries, document submitted to the secretariat of the Andean Common Market, Lima, March 1971, footnote to page 21).

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With regard to the first of these aspects, the stand taken by Brazil at the conference on the patent co-operation treaty marked a new departure, consisting basically in denying the validity of the principle of reciprocity in the light of the concept of international co-operation that has gradually been worked out during the last decade under the auspices of the United Nations. The final acceptance of this concept in recent months as it relates to trade (unilateral and non-discriminatory preferences) gives grounds for extending it to the transfer of technology, and it was for this reason that Brazil advocated that full expression should be given to the desire of all the interested parties to expand the conceptual structure of the examination of patents so as to capture their full significance, not only as regards the adequate protection of the rights of the patent-holder, but also as regards the right of developing countries of varying stages of development to take advantage of innovations without being fettered by undue impediments or exorbitant costs 12/. The backwardness of the developing countries makes it impossible for them to work out entirely new technological solutions to their problems, and they are therefore strongly dependent on the transfer of external technology, so that they should not be burdened with restrictions on the use of technology of tried efficiency: the use of established technology should not drag them into balance-of-payments difficulties, nor should it place on their development process an international burden which never had to be borne by the countries that were in the vanguard of development 13/. Consequently, a patent should not confer on its holder all the advantages of a monopolistic situation, while confronting potential international buyers with all the disadvantages of a total lack of options: on the one hand, the impossibility of any legitimate reinvention of the industrial process and, on the other, the lack of any competition in supply 14/.

In accordance with this general line of thinking, the Brazilian Government formulated four main proposals, which were largely incorporated into the revised version of the treaty on co-operation in patents. In the first place, it suggested reducing the degree of protection granted to technology which, although it may still be adequate for the developing countries, has declined in importance owing to the appearance of innovations in the developed countries. No information was as yet available on the practical methods to be used to put this resolution into effect, however. Secondly, it requested that more information be included in the patent and the international report, so that patents would cease to be instruments containing an absolute minimum of information but assuring their owners of a virtual

12/ In the speech by Thedim Lobo, Head of the Brazilian delegation to the conference on a patent co-operation treaty, at the inaugural session (Washington, 25 May 1970, mimeographed).

13/ Ibid.

14/ Ibid.

monopoly and would be transformed into instruments which, while protecting the rights of the inventor (or the patent-holder), would at the same time provide sufficient information to give a clear idea of the technological possibilities and options open to clients from developing countries. To the same end, it proposed that at suitable intervals of time complete lists of all patents in the world that had passed into the public domain should be prepared and published, such lists being made adequately informative so as to permit a rapid selection of the new processes becoming available in that way. Lastly, it called for measures to be taken to give developing countries more assistance in the establishment of bodies responsible for studying and granting patents which more fully meet their specific needs and, in particular, their needs for the absorption of a wide range of technology at low cost 15/.

To meet the objectives relating to the dissemination of information, it would be possible to use the international search centres which it was decided to set up at the Washington Conference, even though the original intention behind their establishment was to satisfy a concern of the developed countries: that of centralizing patent applications on a world scale and thus avoiding the need for the holder of the original patent to register it in each country. The role that these centres could play in the transfer of technology, as organs feeding national systems of technological information and technical assistance to industry, is dealt with in the last chapter of this work.

In the preceding remarks, all reference to the question of the relationship between the existence of patents and the economic development of both the developed and the developing countries, which is most complex and is also of little practical interest for the purpose of this study, has deliberately been avoided. This topic, which was much discussed in Europe and the United States during the last century, and then thrust into relative oblivion, has nowadays once again caught the interest of the industrialized countries, and a study is being made of its possible influence as a stimulus or hindrance to the development of the Third World. Studies carried out in Latin America in respect of the member countries of the Cartagena Agreement (the Andean Common Market) have arrived at radical conclusions: after affirming that the system of patents is a monopolistic element that favours the position of the industrialized countries by enabling them to transfer technology through licensing and other similar agreements, they conclude that the system is entirely unsuitable and advocate its plain and simple elimination. The system of patents and the laws protecting it, if it is maintained, have arisen through the continuous pressure exerted by groups with concentrated interests on other producers and consumers with "diluted" interests. But for the governments of developing countries, the question remains: why have patents in developing countries? 16/.

15/ Ibid.

16/ Constantine V. Vaitsos, op.cit., page 62.

It may be pointed out in this connexion that the drawbacks of the system which have been observed in the countries of the Andean Group and analysed by Vaitsos do not appear to be common to the whole of Latin America, and in order to eliminate them it is not necessary to break completely with the system, which plays a much more complex and less blameworthy role than that of an element merely designed to consolidate monopolistic conditions in industry. Many of the deficiencies observed could be eliminated or reduced by adapting national laws and administrative regulations on industrial property. With regard to the basic problem, also raised by Vaitsos, of the general utility of that system for the economic growth of the industrialized and developing countries, it would seem relevant to cite the views expressed in 1958 by Fritz Machlup who, considering the problem from the point of view of the United States, concluded that no economist, on the basis of present knowledge, could say with certainty that the system of patents, in the form in which it currently functioned, signified a net gain or a net loss to society. If there were no system of patents in existence, it would be irresponsible, on the basis of present knowledge of its economic effects, to recommend its establishment. But as there had been a system of patents for a long time, it would be equally irresponsible, on the basis of present knowledge, to recommend its abolition 17/. That conclusion was formulated in respect of a highly industrialized country, but it may be asked whether the position of the developing countries is so different as to warrant a clear "no" in answer to the question posed by Constantine Vaitsos. This is an important point which needs to be taken up again at another time.

4. Licensing agreements, technical assistance contracts and other forms of technical co-operation

Although licensing agreements are in many countries the main instrument for the transfer of technology, not all the proprietary technical know-how that is transferred is subject to agreements of this type. Technical assistance agreements for the simple provision of services are also common.

Professor Kurt Politzer, with the Brazilian chemical industry particularly in mind, distinguished three main types of transfer 18/:

17/ From a study carried out for the United States Senate by Stacy V. Jones, op.cit., page 15.

18/ See Kurt Politzer, op.cit. With regard to licensing agreements, see also two documents presented at the United Nations Inter-regional conference on the petrochemical industries of developing countries held in Teheran in 1964: Jerry G. Jenkins, Licensing of Process Know-How, and Samuel Kahn, Patents and Licensing in the Petrochemical Industry.

(a) Acquisition of technical know-how without licensing agreements, in which case the technology is transmitted simply in the form of the provision of services, usually by a consultant firm;

(b) Acquisition of technical know-how through a licensing agreement which represents a straightforward purchase, without continuity of technical information; and

(c) Acquisition of technology through a licensing agreement which provides for the continuing supply of information on future innovations or improvements in the processes whose use is licensed.

Case (a) applies generally to production processes which are already in the public domain and knowledge of which is so widespread that it can be obtained from various sources. Such know-how is obtained through an industrial engineering enterprise which provides services (project formulation) paid for as such. The former practice in this case, which is still followed occasionally, was for the technical know-how involved in the project not to be paid for as such, but to be included without itemization in the cost of the equipment. This practice is dying out in the chemical industry, and indeed in industry in general, however, because of the increasing preference for the preparation of projects prior to and independently of the purchase of equipment. The idea behind this trend is to respond to the increasingly exacting requirements of manufacturing (which is helped by the availability of a project of high technical quality) and to permit the acquisition of equipment at the best possible price, as a result of competition between the different manufacturers who are invited to submit tenders for the supply of equipment.

Politzer also observes that the absence of royalties in respect of transferred know-how included in the project - when the practice is followed of not paying for that know-how separately - is basically more apparent than real, for the industrial engineering firm will try to sell the project relating to the process to be used in the chemical industry concerned at the highest possible price, always including in that price a sum corresponding to the cost of the technical know-how involved in the project, and the more profitable the process offered, the larger that sum will be. There is thus actually an implicit payment for the know-how applied in the project, as something additional to the technical work of preparing the project 19/. Hence, it is more appropriate to analyse licensing agreements, other forms of enterprise-to-enterprise transfer of technology and contracts for the provision of technical assistance (whether this assistance is continuing or is provided only once for the solution of specific problems) separately from the preparation of studies and projects.

19/ This technical work of preparing the project proper (excluding the fees for the use of any specific process) is, generally speaking, independent of the nature and profitability of the process adopted.

Case (b), which relates to contracts for the "once-only" transfer of technical know-how, is paid for in a lump sum, usually on the basis of the installed capacity rather than the production capacity. Payment may be deferred or made in instalments. Once the industrial application of the process or design (depending on the terms of the contract) has been started satisfactorily, with the specified output and standards of quality, the responsibility of the licensor is practically at an end, except for his moral responsibility to help the licensee in the event of difficulties in the industrial operation. This type of agreement is hardly ever exclusive, that is to say, it hardly ever prevents the licensor from granting the same license to another enterprise, and in the event of subsequent increases in the capacity of the licensee enterprise appropriate additional payments must be made.

Politzer goes on to observe that the absorption of technical know-how from this form of transfer is by no means certain, because the contract does not usually provide for the supply of the basic data and background information on which the patented process is based. Moreover, the licensor tries to protect himself through patents whenever possible, and in many cases he tries to maintain the protection afforded to him by patents through permanent research into technological improvements which may result in his obtaining new patents before the original ones lapse, or in replacing the whole process with one that is more profitable.

The problem raised by licensee enterprises with regard to this type of licensing agreement in a country like Brazil is that of the need to reduce or eliminate this passive situation of complete technological dependence for an indefinite future on the development of technical know-how in the highly industrialized countries. A possible solution, which is analysed further in another chapter, would be to link the use of processes obtained through licensing agreements with the parallel application of research programmes on specific related aspects in the licensee firms, with a view to the gradual transfer, in the future, of the original capacity of technological elaboration. In many cases, however, such measures could only be made successful through the co-operation of several licensee companies, perhaps even in more than one Latin American country.

/This type

This type of problem, which is very complex, should preferably be analysed in relation to the concrete situation of specific sectors of industry, and not merely on the abstract level 20/.

Case (c) presupposes the continuation of the link between the licensor and the licensee for a protracted or indefinite period through the automatic supply of information and background material on new technological improvements achieved by the licensor enterprise. As a rule, this type of contract provides for an exclusive licence for a specific geographical area in which the licensee enterprise is to market its products. This aspect is viewed very unfavourably in Brazil nowadays - a point which will be dealt with in other chapters. The contract often includes the right to use trademarks and to draw on ample marketing assistance, as a means of assuring the licensing company that the international prestige of its trademarks and processes will be maintained.

Generally speaking, the payment involved in this type of agreement depends on the sales figures attained by the licensee in the manufacture of the products protected by the license and is calculated as a percentage of the ex-factory FOB sales price. There may also be a down payment, in addition to the periodical payment of the percentage in question, at the moment when the basic technical data are supplied, although, as we shall see, this often conflicts with the regulations and administrative procedures in force in Brazil.

It is also common for payments to be deferred during an initial period, while another common practice is that of laying down minimum annual payments that must be made if the sales percentages do not reach the amounts in question.

Obviously, this type of agreement permits the transfer of a wider range of technical know-how, not only because of the nature of the information transmitted but also on account of the greater need in this type of contract to adapt the production processes and products

20/ At the seminar on industrial co-operation between Europe and Latin America held in West Berlin in July 1971, Professor Jorge Sábato, whose interests include both industrial activities and research, proposed that a number of concrete research programmes should be prepared, on problems which are of interest to more than one Latin American country, in spheres of activity dominated by State enterprises (petroleum, generation and distribution of electric power, rail transport, etc.). The paper in which this proposal is expounded and elaborated will be published in the records of the seminar at the end of this year. A preliminary and less complete version of this paper had already been published some time before the seminar (Jorge Sábato and Natalio Botana, "La ciencia y la tecnología en el desarrollo futuro de América Latina", in IDB/INTAL, Revista de la Integración (Buenos Aires, November 1968)).

to the particular conditions of the country. This obliges the licensee to make adjustments which could involve research and development work, thus leading to gradual but increasingly independent technological development in the country receiving the technical know-how. In another chapter the practical establishment of this trend and the problems that beset it will be analysed.

5. Enterprise-to-enterprise agreements in Brazil,
analysed by types of transfer

In the IPEA study on the enterprise-to-enterprise technology transfer contracts registered in the Central Bank of Brazil and on the payments made for the importation of the technology covered by those contracts, the main results of which are cited in chapter V of this work, the forms of technology transfer are classified in five main categories, defined as follows:

(i) Technical assistance. Permanent advisory or consultant services, or both, furnished by natural or legal persons domiciled or based outside Brazil, involving specialized technical know-how (including engineering in connexion with processes, products and manufactures), which presuppose a permanent link between the contracting parties. The remuneration consists either of a percentage of the gross or net value of the output of the article that is the subject of such assistance, or of a fixed amount per unit produced, with provision in some cases for minimum fees payable by the enterprise using the services.

(ii) Licenses for manufacture or for the use of patents or both. Granting of rights in respect of the design and specification of products subject to definite industrial manufacturing processes, patented and registered in Brazil and in the country of origin, by natural or legal persons domiciled or based outside Brazil, on a basis involving a permanent link between the contracting parties. The remuneration is calculated as a percentage of the gross or net value of the production of the article covered by the contract, or as a fixed amount per unit of production. It should be noted that the legislation in force prohibits remittances for the use of patents from a branch or subsidiary to its parent firm abroad 21/.

(iii) Licenses for the use of trademarks. Granting of the right to use a "registered trademark" or "trade name" owned by natural or legal persons domiciled or based outside Brazil, on such a basis as to involve a permanent link between the parties. The remuneration is calculated as a percentage of the gross or net value of production of

21/ Under Law 4390 any enterprise established in the country of which at least 50 per cent of the voting stock belongs directly or indirectly to a foreign-based enterprise is considered a subsidiary. The IPEA analysis of the available empirical data used a different criterion to define a foreign-based enterprise, as explained in the relevant section of chapter V.

the article for which the trademark is used, and as in the previous case, the legislation in force prohibits remittances from a branch or subsidiary established in Brazil to its foreign-based parent firm. Some contracts granting the right to use patents or supplying technical assistance, or both, include clauses granting the free use of a trademark.

(iv) Engineering services. Temporary advisory or consultant services furnished by natural or legal persons domiciled or based outside Brazil which call for specialized technical know-how and which presuppose a temporary link between the parties. This mode of transfer may be considered as temporary technical assistance comprising supervision of the assembly, installation, operation and adjustment of equipment; supervision and execution of construction; performance of tests and trials; negotiation of purchases; inspection of materials in Brazil and abroad; supervision of shipments; advisory or consultant services of a non-permanent nature in respect of specific questions; recruitment of foreign professionals; training of staff, and other engineering services not specified. The remuneration is equivalent to the total sum fixed in the contract and may be paid in instalments if so provided in the contract, provision being made in some cases for the local party to pay for the hire of staff and for expenditure incurred by the foreign party.

(v) Project preparation. Studies based on specific research or on a stock of information and technical data, in order to supply plants with the designs and final specifications needed for the construction of production units or for the manufacture of industrial products. This mode of transfer involves temporary links between the contracting parties. The remuneration is fixed as a specified sum, which may be paid in instalments if so provided in the contract.

These are the categories - reproduced verbat im - in which the IPEA tried to classify the modes of transfer noted in contracts registered with the Central Bank.

Chapter IV

THE LEGAL AND INSTITUTIONAL FRAMEWORK OF THE TRANSFER OF TECHNOLOGY

1. Introduction

The set of laws and regulations and the institutional system on which the transfer of technology for industrial use is based in Brazil present certain general characteristics which have hampered the adoption of a more rational and effective policy in this matter 1/.

In the first place, the existing legal provisions governing the transfer of technology relate exclusively to the fiscal and foreign exchange treatment given to foreign capital invested in Brazil, since the transfer of know-how has traditionally been considered as merely a subsidiary aspect of the system governing that treatment 2/. These provisions do not reflect any clear approach to or concern with technology as such, and still less with technology as an instrument of industrial development policy. In certain respects, some provisions of the law on companies and of the income tax legislation are also important in determining the system applicable to the transfer of technology from abroad.

Secondly, these laws and regulations governing foreign capital have evolved over several decades during which they succeeded one another, often in only partially modified form, thus giving grounds

1/ This observation is also applicable to the transfer of technology to sectors other than manufacturing: primary sector activities, public utility services and activities of the tertiary sector in general. The legislation and administrative regulations are basically the same for the different sectors of activity.

2/ For a more comprehensive picture of the system governing the treatment of foreign capital in Brazil as it affects the transfer of technology from abroad and has affected it in the past, see IPEA, A transferência de tecnologia no Brasil, op. cit., pages 91 et seq. There are few analyses of the system of treatment of foreign capital in Brazil, still fewer which relate to the transfer of technical know-how, and those which do exist are often politically and ideologically biased. A study by the Inter-American Development Bank entitled Os mercados de capitais no Brasil (CEMLA, Mexico, 1968) deals with various aspects of the system, and publication of the Central Bank of Brazil entitled Capitais estrangeiros no Brasil: Legislação (April 1968) contains a compilation of the legal rules applicable in this connexion.

/for different

for different interpretations in some important respects 3/. Hence, as there is no complete and consistent body of laws and regulations whose application is sufficiently automatic and independent of the consideration of individual cases, but only a group of provisions contained in different legal instruments promulgated at time when different and sometimes conflicting political and economic philosophies predominated, these laws and regulations have to be interpreted.

Thirdly, as a result not only of this relative vagueness of the legal texts but also of the emergence in recent years of more clear-cut views regarding the transfer of technology, the authorities concerned with matters relating to foreign capital - the Central Bank through its Foreign Capital Registration Department and the Banco do Brasil through its Foreign Trade Section (Carteira de Comércio Exterior - CACEX) - have come to assume and play the highly important role of interpreting the legal texts and negotiating the licensing or technical assistance agreements proposed.

This chapter describes the provisions currently in force. Since they are not always too clear and the subject by its very nature, is somewhat complex, it was thought best to try to summarize the main points at the end of the chapter.

2. Legislation on foreign capital and the transfer of technology

Up to 1962 Brazil's legislation on foreign capital had been fairly liberal, with the purpose of encouraging the inflow of capital, but there was an abrupt change with the promulgation of Law 4131 of 27 September 1962, which for the first time revealed a desire on Brazil's part to restrict and tightly control the movement of capital. With some minor alterations and a very few basic changes, this law currently governs the transfer of technology to Brazil through enterprise-to-enterprise agreements.

This law came into being in the midst of a very unfavourable balance-of-payments situation for Brazil, which began to be apparent in 1960 and worsened in 1962, and its background also included a wide political discussion about the rights and obligations of foreign capital and some questioning of its role in Brazil's

3/ See Ricardo Moura, "A instabilidade da política de investimentos estrangeiros", and Nuno F. de Figueiredo, "Regulamentação do Investimento estrangeiro no Brasil", Economica Brasileira, July-September 1955.

development 4/. The regulations for the enforcement of this law were set forth in Executive Decree No. 53451 of 20 January 1964.

Law 4131 and its associated regulatory decree tightened the restrictions contained in previous legal instruments. Thus, remittances of profits and capital refunds were limited to 10 and 20 per cent, respectively, of the registered investment. Moreover, it was prohibited to grant more favourable terms than those applicable to imports in the general category for the purchase of foreign exchange in order to remit profits abroad 5/.

This law and the associated regulations represented the first attempt to deal expressly with the transfer of technology and to try to organize this matter, but they did so in a manner which is also considered too restrictive in some respects. A scale of percentages was established for authorizing remittances of royalties and the like, according to the economic importance to Brazil of the industry for which the know-how was destined, the

4/ A transferência de tecnologia no Brasil, op. cit., p. 93.

5/ A transferência de tecnologia no Brasil, op. cit., p. 94. It should be explained that "more favourable terms than those applicable to imports in the general category", as regards foreign exchange, relate to what was then called "cost exchange", deriving from the existence of a multiple system of exchange rates. For a more comprehensive idea of the exchange system in force and other related questions, see, for example, the study on Brazil contained in a series of studies of the capital market sponsored by the Inter-American Development Bank (IDB). The general view expressed in this study with respect to Law 4131 is that it not only discouraged the inflow of funds but also imposed restrictions on capital already invested in Brazil by persons resident abroad. The hostile treatment provided for by the law was aggravated by the long delay in adopting the relevant regulations (in the absence of which the law was not enforced) and by the nature of the regulations which the Government then in power finally adopted. These regulations contained so many discouraging measures that they caused the virtual disappearance of any new foreign investment (Os mercados de capitais no Brasil, CEMLA, op. cit., pp. 34 and 35). The severity of this view was no longer warranted, however, after the changes referred to later in this document were made.

ceiling being 5 per cent on the invoice value with a maximum period of five years in which deductions could be made by juridical persons in their income tax declarations (for direct taxation purposes) and foreign exchange could be remitted abroad for the transfer of technology. An important feature of this law and also, at least nominally, of the law which later modified it was that remittances of foreign exchange exceeding those limits, either in quantity (over 5 per cent of the invoice value) or time (longer than five years) were not prohibited if the relevant contracts registered at the Central Bank provided for higher margins of recovery, but the amounts in excess of those limits would be liable to the same tax as if they were profits distributed by the enterprise.

This is a theoretical rather than a real possibility, since the authorities consider the above margins established for purposes of calculating the permissible deductions from taxable income as norms which must be observed in order to secure the registration of contracts.

The establishment of time and percentage limits is therefore a provision deriving essentially from income tax legislation, which has strengthened the ample powers of bargaining or persuasion of the authorities responsible for the registration of contracts with foreign enterprises referred to above. It is not a provision specifically associated with an express policy covering the transfer of technology from abroad, however.

In fact, the instrument used by the Central Bank for the review and negotiation of each contract prior to registration is Ministerial Decree No. 436 of 30 December 1958, which established percentage deductions for income tax purposes for the various categories of industries, with the purpose of determining the real profits of juridical persons.

Decree No. 53451 although only a set of regulations for the application of Law 4131 of 27 September 1962, introduced some changes in the organization of the transfer of know-how: it not only limited the period during which funds could be remitted under technical assistance contracts, but it also restricted the amount of those remittances to 2 per cent of the cost of the manufactured product or of gross income from the sale of the manufactures product 6/.

A new law, No. 4390 of 29 August 1964, together with its regulatory Decree No. 55762 of 17 February 1965, partly modified the above criteria. Many provisions were maintained, but others were cancelled, among them the maximum of five years during which funds could be remitted under technical assistance contracts (today this

6/ A transferência de tecnologia no Brasil, op. cit., p. 94.

can be extended for a further five years) and the limit of 2 per cent of the cost of the manufactured product (or of gross income) on the amount of such remittances 7/.

Thus the transfer of technology is currently governed by a number of legal provisions contained in four or five different instruments, their interpretation, harmonization and even their use as negotiating instruments by the authorities being one of the most important aspects of the existing system.

A summary is given below of the provisions in force with respect to the main aspects of the transfer of technology:

- (a) Registration of contracts;
- (b) Recognized forms of transfer of technology;
- (c) Methods of verifying the observance of existing rules;
- (d) Regulations concerning the remittance of foreign exchange to pay for imported know-how, and fiscal regulations;
- (e) Regulations governing contracts between parent firms and subsidiaries and other questions.

3. Registration of contracts

Contracts providing for payment for the importation of technology must be registered at the Central Bank through presentation of the contracts and documents needed to justify the remittance, according to a clause of Law 4131 which was maintained in Law 4390.

Justification for remittances is established when the Central Bank has satisfied itself, on presentation of the relevant technical and economic proof, that the technical know-how requested from abroad is needed and is not already available in Brazil.

7/ With respect to the broader subject of the regulations regarding remittances in connexion with foreign investments, the new legislation revoked the previous limits on remittances of profits and repatriation of capital, but set an annual ceiling of 8 per cent for remittances of profits obtained from the production of luxury consumer goods and services (A transferência de tecnologia no Brasil, op. cit., p. 95). This restrictive provision, too, has yet to be implemented for want of the appropriate regulations.

Moreover, in accordance with a change introduced by Decree No. 55726 establishing regulations for Law 4390, the Central Bank can also approve, if it thinks fit, remittances covering payment for projects or specialized technical services and the purchase of industrial designs and models. Here too it is necessary, in so far as may be reasonably possible, to prove that local technical know-how similar to that covered by the contract does not already exist.

4. Forms of transfer of technology

The legislation in force expressly recognizes only two means of importing technology: authorizations to use trademarks and patents, and technical assistance contracts. Some supplementary legal provisions also make specific reference to two sub-categories of technical know-how: trademarks and ad hoc technical services, i.e., provided once only instead of over a period of several years 8/.

As regards the right to use registered or patented know-how, Decree No. 53451 merely stipulates that a royalty is the fixed payment or percentage paid periodically to natural or juridical persons domiciled, resident or based abroad for authorization to produce articles patented and registered in the country of origin and in Brazil, provided the appropriate legal protection is still in force in both countries.

The same decree defines technical, administrative, scientific or other similar types of assistance as services provided in the individual areas in question by natural or juridical persons domiciled, resident or based abroad who possess specialized technical knowledge which is unobtainable in Brazil.

The references to trademarks and ad hoc technical services as categories to which specific provisions are applicable are to be found in Ministry of Finance Decree No. 436 and Decree No. 55762.

Thus the legal instruments in force do recognize, although not very systematically, the categories of technical know-how referred to in the previous chapter: rights in respect of products and processes, continuing technical assistance, technical aid in the

8/ As may be seen from the legal texts, referred to, the relevant legislation does not expressly define these four categories, owing to the fact that the law, reflecting the prevailing attitude at the time, paid only secondary attention to the transfer of technology in dealing with what was then considered the central problem of the rules governing foreign investment.

form of ad hoc technical services or assistance in the preparation of studies and projects, and authorization to use trademarks.

The stipulation in the law that the assistance requested must be unobtainable locally is more and more strictly applied by the authorities, who require proof that there is no local technical know-how of a similar kind available. This sometimes gives rise to problems which will be dealt with later.

5. Control procedures and mechanisms

The Central Bank has wide supervisory powers which enable it, whenever it considers this necessary, to check that technical, administrative or other similar types of assistance are really being provided to enterprises established in Brazil and that patents and trademarks on which royalties are payable are actually in use, in all cases where foreign exchange is remitted abroad (Decree No. 55762 establishing regulations for Law 4390 which reaffirms the provisions of Law 4131 in this connexion).

It is also necessary to prove that the technical know-how to be used really is protected by law. Law 4390 and Decree No. 55762 stipulate that requests for the registration of contracts for purposes of transfers of funds to cover the payment of royalties on the use of patents, industrial licences, trademarks or the like must be accompanied by a certificate, issued by the National Industrial Property Department 9/, testifying to the existence and validity in Brazil of the requisite legal protection, together with a suitable document proving that this protection has not lapsed in the country of origin.

This requirement for verification of the legal protection naturally necessitates the prior registration of trademarks or patents in Brazil, which often leads to difficulties and delays because of the extreme slowness with which the machinery for the registration of industrial property has so far tended to operate.

6. Regulations concerning the remittance of foreign exchange, and fiscal regulations

The regulations concerning the remittance of foreign exchange to pay for imported technology cover two main aspects: the maximum period during which such remittances may be made, and the limit imposed on the amount. In both respects, the legal provisions relate only to contracts between national or foreign enterprises established in Brazil and unrelated foreign enterprises domiciled abroad.

9/ Now the National Industrial Property Institute, the functions of which have been considerably amplified and which is itself in the process of reorganization.

There are special, more stringent limitations dealt with in the following section in respect of agreements between foreign enterprises established in Brazil and those enterprises' parent firms abroad.

As regards the period during which remittances can be made, the regulations provide that remittances in respect of contracts covering technical, scientific, administrative or other similar types of assistance can only be made the first five years of the company's operation or of its first utilization of the special production process covered by the contract, although this period may be renewable for a further five years if authorized by the Superintendency of Money and Credit (Superintendencia da Moeda e Credito - SUMOC) 10/ (Decree No. 53451, not modified by the subsequent law or decree).

In the case of contracts authorizing the use of trademarks or patented processes, the legislation in force does not lay down any maximum period for remittances, since it is understood (and the Central Bank proceeds accordingly) that this period corresponds to the period of validity of the patents, from the time of registration of the contracts until the patents concerned become public property in the country of origin.

The position regarding the limit imposed on remittances whose amount is calculated as a percentage of the value of sales or production is as follows: the legislation on repatriation of capital sets no limits on the amounts which can be remitted annually in connexion with the importation of technology, but leaves open the possibility of setting certain limits in the event of balance-of-payments difficulties. The legislation lays down that, should there be a serious deficit in the balance of payments or reasonable grounds for anticipating such a deficit, the Council of SUMOC 11/ can impose restrictions for a limited period on imports and on remittances of profits on foreign capital. In such cases, the same authority can limit remittances of funds under the heading of royalties and technical, administrative or other similar types of assistance to a maximum cumulative annual amount equivalent to 5 per cent of the company's gross income (Law 4131, not modified in this respect by the subsequent law and decree).

Therefore, under normal balance-of-payments conditions, remittances are restricted only in so far as they are affected by income tax legislation and the margins for deduction approved by the authorities for calculating the tax payable by juridical persons. Remittances exceeding these limits would seem, at least

10/ Since replace by the Central Bank.

11/ In practice, the Central Bank or the National Monetary Council.

/in theory,

in theory, to be permissible inasmuch as they are not expressly prohibited by the existing legislation. However, in view of the Central Bank's wide powers of negotiation in respect of the registration of contracts, such permission would be given only after each case was considered on its merits, and there are seemingly few cases - or possibly none at present - where higher levels of remittances have been approved. On the contrary, the tendency is for the legal provisions imposing limits on income tax deductions to be quite freely used. The existing legislation lays down that for purposes of determining the profits that are liable to tax, deductions can be made from income tax declarations in respect of sums owing under the heading of royalties payable for the use of patents of invention, industrial or commercial trademarks, and technical, scientific, management or other similar assistance, up to a maximum of 5 per cent of the gross income obtained from the manufacture or sale of the product concerned. It further stipulates that the Ministry of Finance shall establish and periodically review the coefficients by types and branches of production or activity classified in groups according to how essential they are to the economy (Decree No. 53451).

At this point there arises a discrepancy of a legal character which is mentioned in passing in order to convey a clearer picture of the prevailing situation and the difficulties encountered by the administrative authorities, especially the Central Bank.

Decree No. 55762, in the clause cited above, expressly states that the ceiling of 5 per cent of the sums payable under the heading of royalties and other similar items is imposed for purposes of determining the profits that are liable to tax, but it makes no reference whatsoever to the application of this ceiling to remittances abroad in payment of imported technology. This omission is especially significant since the previous Law 4131 and regulatory Decree No. 53451 laid down that the percentage limits were to be established for purposes of both income tax declarations and remittances or transfers of foreign exchange.

Another paragraph of Decree No. 55762 contains a supplementary provision to the effect that remittances exceeding the prescribed limit shall be considered as profits. This seems to strengthen the idea that both the percentage limits and the grouping of activities according to an order of priority are applicable only to the calculation of deductions from the taxable income of enterprises.

If this interpretation is correct, the use made by the Central Bank of the criterion of the national importance of activities for both purposes - i.e., for calculating the permissible income tax deductions by juridical persons and for deciding on the acceptability for registration of contracts providing for remittances of foreign exchange - is a sign of the wide negotiating powers of the Bank, which, as will be seen in another chapter of this study, proposes to lay down even clearer regulations in the near future, with emphasis on essential nature of the technical know-how transferred.

/The fiscal

The fiscal treatment may be summed up as follows: first, the sums remitted abroad in payment for technical know-how may be deducted from the income tax declarations of national enterprises and foreign firms which have no capital links with the foreign enterprise providing the technology. No deduction is permitted in the case of subsidiary companies whose parent firms are based abroad. Secondly, remittances of foreign exchange in payment for technology, up to the maximum amount permitted for purposes of income tax deductions by juridical persons, are subject to income tax at a uniform rate of 25 per cent, to be paid when the remittance is made. Remittances exceeding the prescribed limits are considered as profits ^{12/} and are subject to the following clause of Law 4390: the total net profits and dividends remitted to natural or juridical persons resident or based abroad are subject to a supplementary income tax if the average amount remitted over a period of three years from 1963 onwards exceeds 12 per cent of the capital and reinvested profits registered in accordance with this law. It is further stipulated that the supplementary tax shall be charged at the rates indicated in the following scale:

- when the remittances amount to between 12 and 15 per cent of the total capital and reinvested profits: 40 per cent
- when the remittances amount to between 15 and 25 per cent of the total capital and reinvested profits: 50 per cent
- when the remittances amount to more than 25 per cent of the total capital and reinvested profits: 60 per cent.

This supplementary tax is levied and collected at source at the time of each remittance exceeding the three-year average referred to above. Maximum percentage coefficients for the deductions permitted by the Ministry of Finance in the income tax declarations of enterprises have been worked out on the basis of the criteria mentioned thus far, in line with the following system (Ministry of Finance Decree No. 436 (1958)):

Group I: Basic industries (electric power, fuels, transport, communications, transport equipment, fertilizers and basic chemical products, heavy metallurgy (steel and aluminium), electrical supplies for industrial use, communications equipment, tractors and combine harvesters for agricultural use, cement, road-making equipment, shipbuilding5 per cent

^{12/} As noted previously, this discrepancy practically does not exist in the contracts approved by the Central Bank in recent years, but it could exist and presumably even reach significant proportions in contracts of longer standings which are gradually expiring.

/Group II:

Group II: Essential processing industries, packing materials, food, chemical products, pharmaceutical products, textiles, thread and yarn4 per cent

- Footwear and allied articles, manufactures of metal and of cement and asbestos3.5 per cent
- Electrical equipment, household machines and appliances not considered superfluous, office machines, scientific equipment3 per cent
- Manufactures of rubber, plastic, etc.2 per cent
- Other manufacturing industries1 per cent

Moreover, lump sum payments must relate to the transfer of designs or other technical elements, and must be quite independent of payments in respect of continuing technical assistance or of products or processes for which a percentage may be payable during a maximum period of five years, renewable for a further five years, or, in the case of trademarks and patents, for a maximum period equal to the duration of the relevant legal protection in the country of origin. In other words, what the Central Bank authorities demand is that lump sum payments must be in respect of services actually rendered or technical know-how actually provided. The Central Bank can demand that applicants for the registration of contracts produce evidence that it is normal for the technical know-how or service in question to be provided and that the proposed payment is in keeping with the charges made to other countries, and it frequently does demand such evidence, often in consultation with the Industrial Development Committee of the Ministry of Industry and Trade.

This process of painstaking verification, which is not expressly mentioned in the existing law, is one of the main points in the necessary reforms analysed in chapter VI.

Lastly, another frequent practice which is not expressly laid down in the law or regulations in force but which is compatible with the law and with the regulations on companies is the conversion of all or part of the amounts to which the foreign enterprise providing the information or service is entitled into shares in the recipient company. This practice will also be referred to later.

7. Regulations governing contracts between a subsidiary company and its parent firm abroad

Under the legislation in force, a foreign enterprise established in Brazil may remit payments in respect of technical know-how to its parent firm abroad only when the know-how is transferred in the manner laid down in technical assistance contracts, or when the payments are in respect of non-routine technical services.

/As far

As far as the use of trademarks and patents is concerned, the legislation does not permit the registration of contracts for the transfer of technical know-how between parent firms abroad and their subsidiaries in Brazil which involve remittances of foreign exchange in payment for such transfer. It stipulates that a branch or subsidiary enterprise established in Brazil may not remit foreign exchange in payment of royalties for the use of patents or trademarks to its parent firm abroad when the majority of the capital of the enterprise established in Brazil is owned by those to whom the royalties are payable abroad. It explains that a subsidiary of a foreign enterprise means a juridical person established in Brazil which is directly or indirectly owned by the enterprise domiciled abroad to the extent of at least 50 per cent of the subsidiary's voting stock (Decree No. 55762).

The same limitation applies to this type of contract between foreign enterprises established in Brazil and those domiciled abroad when there is some direct or indirect link between them in respect of capital 13/.

Furthermore, as mentioned in the previous section, amounts remitted abroad by subsidiary or foreign companies in payment for technology transferred by associated firms may not be deducted from income tax declarations: in other words, such amounts cannot be considered as costs.

8. Main conclusions

The legal and administrative system governing the paid transfer of technology as such consists of various provisions and procedures dealing with two major categories of questions: institutional and financial. The first category comprises all the provisions and procedures relating to the transfer and conditions of utilization of techniques introduced into Brazil, which the second includes the provisions most directly influencing the cost to the enterprise of the technical know-how imported.

(a) Institutional aspects

All contracts covering the transfer of technology or the receipt of technical co-operation from abroad must be registered at the Central Bank in order for foreign exchange remittances to be

13/ This may be direct, when the firm domiciled abroad owns part of the capital of the enterprise established in Brazil, or indirect, when there is some link in respect of capital between the firm domiciled abroad which provides the technical know-how and another foreign enterprise which is the parent firm of the company established in Brazil which is receiving the know-how.

permitted. Such registration is not granted automatically, since the law empowers the Central Bank to ascertain both whether the proposed transfer of technology is really necessary and whether the technical know-how envisaged is actually transferred. It is only recently that the Central Bank has made fuller use of these powers, although they were legally authorized some years ago.

Approval of the registration of contracts, which is an indispensable first step, depends not only on the verification and appraisal by the Central Bank, but also on whether the terms of the contract - duration, amount of payment, etc. - are consistent with the limiting regulations which are being increasingly strictly enforced.

The most important of these limitations, as far as the non-financial aspects of the regulations governing enterprise-to-enterprise agreements are concerned, is that prohibiting the conclusion of contracts in respect of products or processes or the right to use trademarks between foreign enterprises established in Brazil and their parent firms abroad, or between such enterprises and other foreign firms domiciled abroad which have some direct or indirect link in respect of capital with the parent firm of the enterprise located in Brazil.

The authorities are also increasingly strictly applying the legislation on prior verification of the inability of Brazilian enterprises, bodies or individuals to provide the necessary technical services covered by a particular contract, as a prerequisite for approving the contract or agreement in question, especially when the services are required in connexion with the preparation of economic or technical feasibility studies and complete projects for the installation of new enterprises.

Existing procedures for the selection of proposed contracts and their possible sectoral orientation according to the priorities established for Brazil's industrial development are incomplete and even inadequate. The existing legislation on foreign capital, which by extension is applicable to the transfer of technology, provides no form of sectoral orientation other than the indirect method of establishing a percentage scale of payments for technology favouring a small number of broad categories of industries. Therefore, the present possibilities for the sectoral orientation of imported technology seem to be very limited.

The situation is somewhat different in practice, however, as will be shown in greater detail in other chapters of this study. All or nearly all the projects for large-scale industrial enterprises (and even for many medium-scale plants) must be approved by the Industrial Development Committee of the Ministry of Industry and Trade if they are to be eligible for the various types of government incentives (customs, fiscal, credit, etc.) designed to promote

/industrial development..

industrial development. Because of the careful study made by sectoral working groups, and subsequently by the whole Committee, a detailed evaluation is possible of the technological contribution represented by each project, both as regards its own merits, in the light of a comparison between sectors and, ultimately, in the light of the overall development strategy adopted. Thus, the possibilities of using the existing institutional structure to select the technology to be imported, although not satisfactory, are far from being negligible or entirely lacking. This question, which is so closely linked to the formulation and implementation of industrial, scientific and technological development policy, referred to again in the following chapters.

(b) Financial aspects

As regards the cost of imported technology, consideration must be given not only to the forms of payment and maximum amounts permitted by the Brazilian authorities for the various categories of technical know-how, but also to the tax treatment given to payments for imported technology.

Payments under licensing agreements for the use of patented products, processes and trademarks take the form of a percentage of the gross production value or sales value for so long as the patents are valid in the country of origin. Payments in respect of technical assistance contracts also take the form of a percentage of the production or sales value of the patented articles or those produced by means of the patented processes where technical assistance is provided on a continuing basis, i.e., for periods of up to five years, renewable for a further five years. These percentages vary according to a table which is calculated on the basis of how essential the products are to Brazil's industrial development and which ranges from 1 per cent (for trademarks of no technological importance) to 5 per cent (the maximum authorized for what are considered to be the most essential industries).

As regards possible technical assistance, i.e., the assignment of technical experts, the carrying out of studies for the solution of specific problems or the preparation of studies and projects, payment is authorized in the form of a total sum for which there are no pre-established limits. The Central Bank, often in consultation with other Federal bodies (the Foreign Trade Department of the Banco do Brasil and the Industrial Development Committee of the Ministry of Industry and Trade), checks whether the sums proposed by the enterprises concerned and stipulated in the contracts are reasonable, in the light of technical and economic criteria obtained either from comparison with similar cases in each body's experience or through estimates and consultations with independent technical agencies in Brazil or abroad.

/The payment

The payment of lump sums in addition to annual percentage payments in respect of transfers of patents for products and processes or of technical assistance contracts is authorized only when it specifically covers the provision of some technical service or technical documentation (and when this fact is expressly stated in the relevant contracts registered at the Central Bank). The amount of the payment is assessed in relation to the importance of the service or documentation, and a special procedure is followed for evaluating and approving the proposed payment, often with the collaboration of technical and financial agencies, along the lines of that described in connexion with the provision of isolated technical services.

Another very important factor in determining the cost of technology imported through enterprise-to-enterprise agreements is the tax treatment applied in respect of the payments provided for in the agreements.

In this respect, the two main factors are, first, the deductions allowed by the tax authorities in calculating net income for tax declarations, i.e., the proportion of the payment for technology that can be considered as industrial operating costs (not profits) in the calculation and payment of income tax by the enterprise concerned, quite independently of the remittances of foreign exchange which may or may not be involved; and, secondly, the fiscal treatment (as regards income tax) applied to remittances of foreign exchange in payment for technology transferred from abroad under contracts previously registered at the Central Bank.

In both respects, the regulations in force apply different treatment to two broad categories of enterprises: foreign firms which are subsidiaries of parent firms based abroad or which, though not subsidiaries, have concluded contracts for the transfer of technology with companies domiciled abroad with which they have some link in respect of capital (either directly or through their parent firms); and all other enterprises, including independent foreign companies and Brazilian firms. For the sake of brevity, the first group will be called "tied enterprises" and the second "independent enterprises" 14/.

14/ It must not be forgotten that this classification relates specifically to links in respect of capital in so far as these affect the restrictions on the transfer of technology. Thus, for example, a foreign enterprise established in Brazil which has contracts for patents or technical assistance with an enterprise abroad with which it has no significant direct or indirect link as regards capital belongs to the category of independent enterprises, even if it is a subsidiary whose parent firm is based abroad.

The legal-administrative treatment applied to these two broad categories of enterprises in the two financial respects referred to above is as follows:

Tied enterprises (which are not permitted to conclude licensing agreements and may import technology only under contracts covering technical assistance and specific engineering services or the preparation of studies and projects) cannot enter under the heading of costs in their Brazilian income tax declarations payments for imported technology calculated according to the percentages laid down in the contracts registered at the Central Bank. Therefore, these sums cannot be considered as costs, but only as part of the firm's financial returns. Such firms may, however, effect their remittances of foreign exchange in respect of the registered contracts covering the transfer of technology in accordance with the percentages or other forms of payment laid down in those contracts.

Independent enterprise (which are permitted to conclude licensing agreements and other types of arrangements for the transfer of technology, provided these are registered and approved by the Central Bank) may consider such payments as operating costs in their income tax declarations and remit the corresponding sums abroad.

Remittances of foreign exchange in payment of technology in both categories of enterprises are again liable to a tax on income, in this case at a uniform rate of 25 per cent. This is a different tax, of course, from that charged annually on the net income obtained by enterprises as juridical persons and from that applicable to remittances of profits and dividends abroad. In both these cases (net income of juridical persons and remittances of profits and dividends), the incidence of this tax is progressive. In the case of the income tax applicable to remittances of profits and dividends, which is more closely connected with the transfer of technology in view of the possibility of "compensating", through bigger transfers of profits and dividends 15/, for payments for technology authorized by the Central Bank but considered insufficient by the enterprise, the progressive scale of the tax has already been described.

Lastly, another point worth mentioning is the possibility of making payment for a specific contribution of foreign technical know-how in the form of shares representing a given proportion of the capital of the firm receiving the technology. This form of payment is permissible, but, according to the law governing limited companies, authorization is subject to an assessment of the technical

15/ This possibility is obviously greater in the "tied" category of enterprises.

know-how provided by the foreign enterprises, carried out by a panel of experts and approved at the general meeting of the enterprise located in Brazil. It is also subject to approval of the verdict of the panel of experts by the Foreign Capital Registration Department of the Central Bank.

Chapter V

ANALYSIS OF ENTERPRISE-TO-ENTERPRISE AGREEMENTS
IN BRAZIL

1. Nature of the data

Payments made as remuneration for imported technology used in the industrial development of Brazil, the nature and origin of this technical know-how, and its destination in the country by branches of industry were all studied recently by the Institute of Economic and Social Planning (IPEA) which comes under the Ministry of Planning and General Co-ordination. The study is based on the statistical analysis of the contracts on transfer of technology registered in the Central Bank and the external payments corresponding to them 1/.

As mentioned in the last chapter, registration of these contracts in the Central Bank was only introduced in Brazil in 1962, under Law No. 4131 of 27 September 1962. The register contains relatively concise information on the technology it is planned to transfer - the date on which the contract was drawn up, specifications of the type of technology and of the production process in which the transferred technology will be used, and also the amount and form of payment of the planned remuneration - but does not include any of the information obtained in the periodic evaluation of the results achieved after some years of application in Brazilian enterprises of the technical know-how brought in by this means from abroad.

According to the IPEA study, the register of these contracts and that of the respective bank payments abroad contains the information needed to make a rough appraisal of the nature and destination, by sectors and types of enterprise, of the foreign technology acquired by Brazil between January 1963 and December 1969 2/.

This information from the register of contracts and the register of payments abroad, which relates exclusively to manufactory, forms the empirical basis of the IPEA's work which is summarized in this chapter.

First of all, mention should be made of a number of limitations inherent in the study which originate in the actual data used (the only ones available in the country). Perhaps the most important of these is the fact that, for different reasons, the payments provided for in the contracts do not always result in actual transfers of foreign exchange.

1/ IPEA: A transferência de tecnologia no Brasil, op. cit.

2/ The data on payments do not correspond to the payments laid down in the contracts registered, but to the payments actually made through the national banking network during the period of the contract, and later communicated to the Central Bank.

To begin with, the check on payments made in connexion with the transfer of technology does not always make it possible to identify their nature or to separate them from payments which are simply remuneration of capital. This limitation was particularly felt at the beginning of the period under consideration. Moreover, the Central Bank has no information on the value of the remittances corresponding to transfers of technology financed by international agencies, because in these cases payments made between the Brazilian and the foreign enterprise are effected abroad and do not incur an immediate disbursement of foreign exchange. In the majority of cases, it is state or mixed enterprises which are involved in this type of financing. Lastly, owing to difficulties of an administrative nature, the analysis of payments only covers the period 1965-1969.

Secondly, the contracts analysed - those registered between January 1963 and December 1969 ^{3/}, do not accurately reflect the technology brought into the country during this period, since contracts drawn up before this starting date, and hence not liable to registration, were still in force, while other contracts drawn up and registered in the Central Bank towards the end of the period considered in the study were included in the tabulations of contracts although in some cases (perhaps even in many cases, bearing in mind the recent acceleration of Brazil's industrial development) they had not resulted in financial remittances abroad.

There is, of course, another basic limitation - the assumption that a flow of monetary remittances in payment for the transfer of technical know-how actually does correspond, fairly approximately at least, to the actual transfer of technical know-how and is not a mere financial expedient to increase the remuneration of foreign capital invested in the country. The IPEA study shows that there exist grave doubts as to whether these remittances do correspond to the actual transfer. It says that even in cases where the contract is presumably fulfilled and gives rise to remittances, the absence of strict control by the Central Bank means that the payments made may not correspond exactly to the entry of foreign technology, but may in fact correspond to remittances of profits abroad concealed under the heading of payments for the transfer of technology. In these cases, which are common among the foreign enterprises, the contract is taken to be an indication of the absorption of foreign technical know-how by the national system of production but is actually merely a legal instrument to justify the sending abroad of financial remittances ^{4/}. Under the institutional system now existing, it is difficult to check whether the transfer of

^{3/} It should be borne in mind that there was no obligation to register contracts prior to January 1963. The legal obligation to register them was established under Law No. 4131 of 27 September 1962.

^{4/} IPEA, op. cit.

technology provided for in the contracts registered in the Central Bank does in fact take place; this constitutes one of the main aspects of the modifications now being studied.

Another practice worthy of mention, which is quite frequent in the automobile, chemical and pharmaceutical industries and which also contributes to the fact that not all bank payments imply an immediate disbursement of foreign exchange is the practice of regarding the financial remittances in respect of the transfer of technology (as laid down in the contracts) as only symbolic remittances, while at the same time considering them as entries of external resources into Brazil in the form of credits or investments made by the foreign contracting party. In the IPEA study, however, it was considered that this symbolic operation represented a real payment, and the amounts involved were added to the bank remittances actually made in the same category and sector of industry 5/.

It proved necessary to adopt other measures in the study to counter-balance, at least in part, the limitations of the original data available, and to make as compatible as possible the information on contracts registered and external payments made. For example, a single agreement or contract with a foreign enterprise often includes several different categories of transfer of technology which require to be distinguished for the purposes of the study. The payments appearing in the accounts of the Central Bank do not indicate what part of the total remittance corresponds to the different categories. The IPEA study solved this difficulty by breaking down the legal registered contracts, for purposes of classification and analysis, into the different categories of transfers figuring in each. The problem of breaking down the payments for the transfers was solved by dividing the payments made under specific contracts by the number of categories of transfers, i.e., by the number of contracts made under the new system, allocating equal amounts to the different categories. Thus, for example, in a legal contract covering technical assistance and the granting of licence to use a trademark, the payments were divided equally between a technical assistance contract and another granting a licence to use a trademark 6/.

The theory underlying the criterion used is of course debatable, but in view of the information available there was no alternative but to adopt it, in the absence of a more plausible and more applicable theory.

5/ It would be very interesting to know to what extent this practice of "reinvestment" in the country of the amounts covering under the heading of remuneration of technology is followed. Unfortunately, the IPEA study has no data on this. The impression gained from contacts with industry, however, is that this practice is becoming increasingly common.

6/ IPEA, op. cit., page 49.

When the results are being interpreted, however, this system should be borne in mind, especially in connexion with the possible distortion arising at this point in the form of excessive figures for payments in respect of the use of trademarks, since in the contracts considered the percentages of remuneration in this category of transfer of technology are generally (even in the earliest registers) lower than those for technical assistance or the use of manufacturing processes 7/.

An analysis was made of 1,224 entries registered in the Central Bank up to 31 December 1969, and under the system of classification mentioned above (i.e., by categories of transfer of technology provided for in each register) these gave 1,665 tabulated contracts, all involving the manufacturing industry (excluding the petroleum products the manufacturing sector) 8/. These latter contracts were excluded because, in view of the large number of them signed by Petrobras, their consideration would distort the pattern of the general characteristics of technology imports by the industrial sector 9/. In the period under consideration, the number of enterprises established in Brazil originating such contracts was 614. Of the 1,665 agreements made with legal or natural persons abroad, which formed the empirical basis of the study, only 1,229 (74 per cent) gave rise to remittances in the period 1965-1969.

The data on the contracts and payments made - with all the methodological adjustments required - were tabulated and analysed in terms of the following characteristics:

- (i) branches of industrial activity;
- (ii) destination of goods in each sector according to use: capital goods; intermediates, consumer durables, consumer non-durables (as a mixed category), and automobile industry components;
- (iii) nature of the technology transferred;
- (iv) countries of origin of the technology transferred;
- (v) ownership of receiving enterprises and relation with enterprises transmitting technology.

7/ According to the rules at present used by the Central Bank, the maximum percentage remuneration allowed for agreements on the use of trademarks is 1 per cent of the gross value of sales production. This limitation, however, has only been applied to imports of technology, by extension of the ruling on income tax, in recent years. It is assumed that contracts drawn up at an earlier period - which have gradually been reaching their term of expiry - provided for higher percentages of remuneration.

8/ As at 31 December 1969, 1,892 agreements concerning the primary, secondary and tertiary sectors of the economy had been registered in the Central Bank.

9/ IPEA, op. cit., p. 22.

The main conclusions on each of these aspects will be summarized and analysed from the point of view of the number of contracts registered and especially of the annual external payments 10/. To begin with, a brief analysis will be made of the overall cost of technology imports in the manufacturing sector in Brazil (excluding oil refining).

2. Cost of technology imported by the manufacturing industry

(a) Overall cost

The IPEA study only includes the manufacturing industries, excluding oil refining, while the balance-of-payments figures given by the Central Bank in its annual reports refer to the transfer of technology for all economic activities. Table 1 gives these figures in dollars at current prices of the year indicated.

It is possible that, as the IPEA study indicates, the analysis of payments under contracts registered in the Central Bank it may suffer from some degree of underestimation, due to difficulties in the preparation of the original data and other causes, especially in the initial years.

Moreover, the growing practice of ploughing back the remuneration for technology imports into the recipient enterprise as an investment by the firm which is the external source of the technology means that the annual amounts figuring in the first column of the table may not correspond to the expenditure of foreign exchange actually made.

According to the above data, the expenditure on importing techniques and technical know-how in general (including concessions of trademarks) in the processing industries (excluding the petroleum industry) would account for 55 per cent of the total expenditure as an average for the period and 58 per cent in the last year considered. This percentage has tended to grow gradually in keeping with the reactivation of industrial development which began in 1967.

According to the provisional and official data on the balance of payments for 1970, this tendency increased sharply in that year. These data, here considered only as indicators of size, indicate for 1970 an increase in external payments for technical and administrative assistance to 90 million dollars and for licensing contracts (trademarks and patents) to 20 million. Assuming that the percentage of expenditure on technology by the manufacturing sector in 1969 remained constant, the 1970 figure for payments for technology imported by the industrial sector would be approximately 63.8 million dollars.

10/ It should be mentioned that the procedure adopted in the IPEA study, whereby foreign payments are divided by the number of "contracts" corresponding to the different types of transfer of technology in the register, only affects the tabulations as regards, the type of technology transferred. In this respect, however, it seriously limits the value of the results obtained from the analysis.

Table 1

PAYMENTS FOR TRANSFER OF TECHNOLOGY IN THE
MANUFACTURING SECTOR AND IN ECONOMIC
ACTIVITIES AS A WHOLE

(Million of dollars at current prices)

Year	Manufacturing industries, excluding petroleum and petroleum products (IPEA)	Balance of payments, Central Bank		Total
		Technical assistance and management contracts	Licensing contracts (patents and trademarks)	
1965	20.1	41.8	0.7	42.5
1966	24.1	42.9	2.9	45.8
1967	32.6	54.9	7.8	62.7
1968	40.9	62.8	7.4	70.2
1969	52.4	83.9	6.9	90.8

A brief evaluation will now be made of the meaning of these figures, in comparison with the overall balance-of-payments figures for imports and with the figures for the gross domestic product and the industrial product, and they will be compared with the same figures for other countries 11/.

It should be mentioned before we go any further that the expenditure on imports of technology shown in table 2 does not only refer to manufacturing, but to the whole group of economic activities which drew up any kind of technical assistance contracts with the exterior. The comparisons are thus relatively meaningful when they refer to total imports and to the gross domestic product, but rather more uncertain when only the industrial product is involved, since they assume a constant percentage of imported technology for the manufacturing sector.

A first look at the data in table 2 shows quite a moderate tendency for expenditure on imports of technology to increase in proportion to total imports and to the gross domestic product and the industrial product, despite the rapid increase in absolute terms of payments for the transfer of technology. An increase was to be expected in view of the accelerated rate of growth of the economy in the last few years and the growing importance of the factor of technological innovation in the development of the country 12/, but the proportional expenditure continues

11/ Mexico, whose external trade figures were lower than those of Brazil, spent around 200 million dollars per year on imports of technology at the end of the 1960's; this figure shows an annual increase of approximately 20 per cent (see Miguel S. Wionczek, Los problemas de la transferencia de la tecnología en el marco de la industrialización acelerada: El caso de México), IDB (mimeographed), June 1970, p. 6.

12/ In chapter I some data were given on the importance of technological innovation in the growth of the Brazilian economy as from 1947. These data do not cover the last few years, but the fact that the Brazilian economy has been growing at an overall annual rate of around 10 per cent without any appreciable increase in the rate of capital formation, although there no longer exist any substantial amounts of under-utilized production capacity, seems to indicate that the technological innovation factor has become more important in the growth process. In view of the very limited level of national activities in the field of technological research both in the enterprises and in the official technological institutes, it is easy to appreciate the absolute and relatively increasing influence of the technology imported through licensing and other agreements and also, as a result of foreign investment in so far as this brings in technical know-how without any need for special agreements.

Table 2

IMPORTS OF TECHNOLOGY AS COMPARED WITH TOTAL IMPORTS, THE GROSS DOMESTIC PRODUCT AND THE INDUSTRIAL PRODUCT

Year	Annual growth of expenditure on imports of technology	Annual growth of gross domestic product in real terms	Percentage of total expenditure on imports of technology compared with total imports	Percentage of total expenditure on imports of technology compared with gross domestic product	Percentage of expenditure on imports of technology compared with industrial product
1959	-	5.6	2.8	0.18	0.67
1960	21 %	9.7	3.2	0.21	0.73
1961	15 %	10.3	4.6	0.22	0.75
1962	-34 %	5.3	0.4	0.14	0.47
....
1966	8 %	5.1	3.38	0.38	0.62
1967	37 %	4.8	4.3	0.24	0.83
1968	11 %	8.4	3.8	0.25	0.80
1969	29 %	9.0	4.5	0.29	0.81
(1970)	22 %	9.6	(5.0)	(0.31)	(0.87)

Source: Up to 1969, data from the Fundación Getulio Vargas and the Central Bank; 1970, unofficial estimates. 1963 and 1965 were excluded because in those years political factors resulted in totally anomalous behaviour of the phenomena being studied.

/to be

to be low in comparison with that of other countries which depend less than Brazil on external technology. Thus, for example, in 1964 the percentage of the domestic product devoted to the importation of technology was 0.15 per cent in Western Germany, 0.14 per cent in France and 0.13 per cent in England 13/.

Another significant comparison between Brazil and Japan appears in table 3.

Table 3 shows that there is a distinct resemblance between the percentages recorded for Brazil and Japan. Both this comparison and that previously made with three European countries would seem to emphasize how relatively small the transfer of external technology to Brazil is, as measured by the corresponding payments, when it is borne in mind how much the economic growth of the country depends on imports of technology and processes from abroad, at least in the short and medium term. It would therefore seem that there is no overall problems of too high an expenditure of foreign exchange on imports of of technology, but rather an insufficiency of expenditure vis-à-vis the growing needs of national technological progress and the difficulty of satisfying them over the short and medium term extending applied research and technological development work inside the country. This insufficiency also raises the question of determining whether national industry can absorb foreign technical know-how more rapidly than the figures of the previous table show, this being associated with structural problems of industry dealt with later in the present paper.

The importance of the amount of technology imported could be evaluated as a function of the total expenditure devoted to pure and applied research in the country itself: the ratio between the technology imported and that produced in the country would provide an indicator of the degree of adaptation, modification and improvement to which technical know-how obtained from abroad was subjected. A high ratio would indicate a basically passive attitude towards imports of technology, while a lower one would indicate that greater efforts were being made to adapt technology and aim at the gradual attainment of technological independence. From this point of view, the comparison between Brazil and Japan shows differences, since Japan assigns four times as much, in absolute figures, to its own research as to imports of technology 14/.

13/ Fernando Fajnzylber, Sistema industrial y exportación de manufacturas: Análisis de la experiencia brasileña, Rio de Janeiro, November 1970, p. 159.

14/ C.H.C. Oldham, C. Freeman and E. Turkcan, The transfer of technology to developing countries, with special reference to licensing and know-how agreements, UNCTAD, November 1967.

Table 3
COMPARISON OF EXPENDITURE ON IMPORTS OF
TECHNOLOGY BY BRAZIL AND JAPAN

Year	Expenditure on imports of technology as a percentage of the gross domestic product		Expenditure on imports of technology as a percentage of the industrial product	
	Brazil	Japan	Brazil	Japan
1959	0.18	0.11	0.68	0.79
1960	0.21	0.22	0.73	0.91
1961	0.22	0.21	0.75	0.88
1962	0.14	0.19	0.47	0.80
1963	-	0.20	-	0.84
1964	-	0.19	-	0.84
1965	0.17	0.19	0.63	0.83
1966	0.18	0.19	0.62	0.83
1967	0.24	0.20	0.83	0.85
1968	0.25	0.22	0.80	0.93
1969	0.29	0.20	0.81	-

Source: Data on Japan: Economic Planning Agency and Science and Technology Agency of Japan.
Data on Brazil: previous table. Data on Brazil for 1963 and 1964 have been omitted because they correspond to a period of crisis.

/In Brazil,

In Brazil, on the contrary, the estimated ratio in the last few years was approximately 1 to 0.8 ^{15/}, although at present, since there was an increase of slightly more than 20 per cent annually in expenditure on imports of technology over the last two years and it is estimated that there was a relatively greater increase in expenditure on pure and applied national research, this ratio is tending to improve.

This comparison, however, brings in the risk of considering the possibility that the behaviour of Brazil and Japan may be similar in this respect. The similarity between the first figures given is an anomaly, since it was to be expected that imports of technology by Brazil would be much greater, both in comparison with total imports and compared with the gross domestic product and the industrial product. The low figures recorded indicate that national industry lacks capacity to absorb technology and also suffers from associated structural deficiencies; this is a problem of the first magnitude, calling for vigorous modernization, reorganization and technical assistance policies. The disparity between the situations of Brazil and Japan as regards the relation between each country's imports of technology and its own development of science and technology is of course quite natural, in view of Japan's long tradition and experience in the development of science and technology, and it would seem ill-advised to want Brazil to try to emulate Japan by increasing too rapidly its expenditure on science and technology, for as was noted in connexion with other countries ^{16/}, the expansion of research and development activities diverts scarce human resources away from industry and may redound to the detriment of a country's economic development, especially if the rate of increase of such activities exceeds the capacity to organize or improve institutions and formulate policies to make efficacious use of them.

Various international comparisons show that there is no very close correlation between expenditure on research and development, expressed as a percentage of the gross domestic product, and rates of economic growth. The different development strategies and different institutional conditions of each country contribute towards creating unequal situations. Thus, for example, since the war the growth rate of the gross domestic product of the Federal Republic of Germany has considerably exceeded that of the United Kingdom, despite the fact that the latter country has made a much more intensive technological research and development effort,

^{15/} F. Fajnzylber, Sistema industrial y exportación de manufacturas: Análisis de la experiencia brasileña, op. cit. p. 167.

^{16/} B.R. Williams, Technology, Investment and Growth, London, 1967.

in comparison with its product. In support of this thesis, it may be noted that for many years the "technological balance of payments" of the Federal Republic of Germany stood at a deficit 17/.

The situation should therefore be reviewed in the light of the particular situation of each country. The last chapter of this study will come back to the question of the policy which seems most advisable for Brazil.

It can clearly be seen, however, that the problem of (apparently) insufficient overall expenditure on imports of technology is closely linked to the existence of various obstacles connected with inadequate sectoral distribution of payments for transfer of technology; lack of any real correspondence between the financial flows (payments) and the actual technical know-how received; dominance of branches of foreign-based enterprises among the companies in the country which import technology; lack of any link between the sectoral structure of technology imports and a sectoral development strategy; etc. These aspects are brought out in the analysis made in the following sections of this chapter, but first of all consideration will be given to the problem of the cost of the transfer of technology from the point of view of individual and other similar licensing contracts. Detailed consideration is given in this study to the remuneration aspects of some contracts considered typical of their respective branches of industry.

(b) Remuneration of technology in contracts

The forms and amounts of remuneration are extremely varied, as we have seen in the concrete cases of licensing agreements for technical assistance or technical assistance and know-how examined in detail in this study. The observations which follow are based on a sample of enterprises selected as illustrations from the mechanical engineering (machinery manufacture) chemical, and pulp and paper industries. The majority of the 23 enterprises analysed have contracts for importing technical know-how which were drawn up as their production expanded and as they added new products, and these contracts often provide for different methods of transfer of technology.

Close analysis of these cases also gives an opportunity for an appreciation of other major features: the country of origin of the technology imported by individual enterprises, the higher frequency of technical assistance agreements (especially in connexion with production engineering), the frequent inclusion free of charge of rights

17/ B.R. Williams, op. cit. pp. 8 and 9. However, this could be partially explained by the fact that a large number of German patents of invention were confiscated by the Allies at the end of the Second World War: this undermined the German capacity to export patented technology, but did not affect to the same extent the possibilities for making use of the country's own techniques and technical know-how.

to use patents or trademarks (perhaps because of the prohibition of agreements providing for payment for such rights between branches of foreign enterprises and their parent firms or between enterprises in Brazil and foreign enterprises with which they have financial links, and the existence of older contracts whose duration exceeds the limits later fixed by the Central Bank for the registration of contracts submitted for approval. There are also cases of contracts where the percentages of remuneration exceed present limits, although they are in keeping with the terms of contracts registered before the present provisions came into force.

It should also be noted that agreements concerned exclusively with the granting of patent rights are uncommon. Out of 12 contracts for the transfer of technology in the five mechanical engineering enterprises considered, only one included the use of the patent for the product or process, and another two included the use of the trademark. In view of the importance of product engineering in the manufacture of machinery and equipment and the fact that the sector is weaker in this area than in production engineering, it was to be expected that there would be larger-scale recourse to licensing agreements bringing technical know-how regarding product design or the utilization of processes. The greater frequency of technical assistance agreements would seem to indicate greater weakness in production engineering, but the true situation may well be different. As we have already seen, foreign enterprises which are not independent in the eyes of the law can only import technical know-how through technical assistance agreements (as in the case of possible technical services and project preparation services). This legal provision may have led to the concentration mentioned, which also illustrates how little the national enterprises, which already have a sufficient mastery of operational technology, have recourse to licensing agreements to obtain patents for products or processes in order to strengthen their know-how in product engineering - a field in which they generally seem rather weak.

In the chemical pulp and paper industries, the 65 contracts in force in the 18 enterprises which were taken as an example in these sectors reveal a similar, albeit less pronounced, predominance of technical assistance agreements. In the sample of enterprises considered, there was not one which imported technology solely through patents for products or processes, without technical assistance in the manufacturing operations. The sample is reasonably representative of the situation predominating in the whole of this branch of industry.

As regards the remuneration paid and the duration of the contracts, in the majority of cases the limits established by the law governing Brazil's imports of technology prevail. The highest levels of remuneration and the longest durations are to be found in the contracts registered before the present legal and administrative provisions came into force. As is quite natural, the duration of some of these contracts connected with the utilization of trademarks or patents depends on the duration of the legal protection of the trademarks or patents in the

/countries of

countries of origin and in Brazil. These contracts will therefore expire in time or be replaced by others based on new registrations of trademarks or patents, which will be in keeping with the new provisions restricting the duration and the percentages of remuneration. Not all the contracts which are in this situation, however, involve the utilization of trademarks or patents, since many of them are simple contracts for technical assistance. Some of them are of indefinite duration, as was permitted by the previous legislation, although this could have been avoided by extending the application of the administrative provisions on income tax, as has been done in recent years. These contracts create problems, since on the one hand they have no real technological content or do not meet the needs of production engineering, which has already been mastered by Brazilian industry, while on the other hand they also give rise to the legal problem of the retroactive nature of the legal provisions needed to regulate more explicitly and accurately the importation of technology.

Generally speaking, the sample of enterprises from these three branches of industry suggests that the level of remuneration and the duration of contracts for the transfer of technology are reasonable in terms of international practice and the data which has been produced on some countries 18/. This does not mean that national or international practice in the licensing of patents is satisfactory, nor that there are no problems requiring immediate solution both internally, through the more appropriate organization of imports of technology, and externally, through international co-operation measures.

Another point which is frequently mentioned in connexion with the technology imported by the developing countries is its "implicit cost", i.e., the extra production or investment cost stemming from the unsuitability of the processes or products licensed. According to some authors, this additional cost margin has increased in the transfer of technology for the industrial development of Latin America during the

18/ The conclusions of some researchers on this topic in other countries have been different. See, for example, Miguel S. Wionczek, Los problemas de la transferencia de la tecnología en el marco de la industrialización acelerada: El caso de México, IDB (mimeographed), June 1971, p. 6; Constantine V. Vaitsos, Strategic choices in the commercialization of technology: the point of view of developing countries, IDB, June 1971; Simon Teitel, Notes on the transfer and adaptation of technology in Latin America, IDB (mimeographed), May 1970, p. 18.

last few decades ^{19/}. The studies made in Brazil have not reviewed specific aspects of the problem such as the choice of the techniques and processes most suited to local conditions, the capacity of the local enterprises for economic calculation and technological evaluation, the adequacy of the methods of industrial promotion used in the country (especially in the big enterprises or the enterprises of the public sector), the magnitude of the distortions in the system of prices of products and factors, the influence of these distortions on estimates of the economic viability of investments (possibly distinguishing between private and social economic viability), etc. An adequate analysis of all these problems would have required a large amount of information which was not available and which could not be compiled and analysed in a reasonable space of time. In addition, the limits of the initial problem of the transfer of foreign technology would have become confused to an even greater extent with those of the much more general problem of the distribution of the resources of production in the process of development. For these reasons, these points were not analysed in this study.

Two observations, however, may be made on what would appear to be the two main aspects of the question of "implicit costs". One of these is the capacity of the local entrepreneurs to identify, select and negotiate the techniques, processes and products best suited to the conditions of the country, and to resist the pressure (perhaps inevitable, in view of human nature and the harshness which has always characterized both public and private international relations) applied by the licensor enterprises in order to sell what suits them best at the highest possible price. In order to diminish or suppress the "implicit costs" of the transfer of technology from abroad, it is essential that the entrepreneurial capacity of the country be increased. This would mean

^{19/} Simón Teitel, op. cit., pp. 20-22. In addition to the lack of adaptation of the techniques selected, Teitel includes in the "implicit costs" some restrictions incorporated in transfer agreements, such as the obligation to buy raw materials and equipment or the prohibition of exports to third countries or countries not specified in the agreements. It does not seem entirely appropriate to class these three restrictions as "implicit costs", but the introduction of restrictions on the choice of techniques, or the adoption of procedures which could lead to the choice of appropriate techniques do of course come under this heading. The other two restrictions should, however, be viewed from another angle. The obligation to buy raw materials or equipment would indicate that competition is limited or non-existent, while the limitation of export markets can only be analysed and criticised in conjunction with the other provisions relating to licensing agreements; this will be reviewed in the next chapter.

On the choice of techniques and their relation to the cost of the technology transferred, see Constantine Vaitzos, Transfer of industrial technology to developing countries through private enterprise, Bogotá, February 1970.

pushing ahead with several government programmes recently introduced in Brazil for the amalgamation, concentration and reorganization of enterprises, while at the same time it would be necessary to initiate new programmes of technical assistance and development of industry - oriented scientific and technological research. The last chapter of this paper will refer to these programmes, which are increasingly necessary and should have an important place in an effective policy for the transfer of external technology. Another important element of the "implicit costs" stems directly from the situation of monopoly or of limited competition which is to be observed in the supply of licences for products or processes in many branches of industrial activity, especially in the chemical and electronic industries, and the non-ferrous metals or alloys industry. The problem does not actually lie in the increased cost of technology resulting from the non-competitive structure of supply (this increased cost does, of course, exist, but gives rise to a different problem), but in the holding back of information which goes beyond what is legitimate and acceptable for the legal protection of patents or trademarks. This lack of information makes it even more difficult for the entrepreneurs of the developing countries to select the techniques and processes most suited to their countries' production resources and markets. International co-operation cannot modify to any great extent the monopoly or the limited supply of licenses which belong to private enterprises rather than public agencies, but it could establish a more balanced institutional framework for international legislation on trademarks and patents, aimed at increasing the dissemination of information on products and processes still protected by valid trademarks and patents and distributing the technical know-how which legally comes within the public domain but which the developing countries have difficulty in obtaining, either owing to their own limitations and difficulties or owing to the inelasticity of the international system for the transfer of non-patented information. This latter aspect naturally comes within the responsibilities of the public authorities of the developed countries, and may therefore be improved as a result of international co-operation 20/.

20/ On the subject of certain demands put forward by the Brazilian Government in this context, see chapter III, section 3. To limit the degree of monopoly or oligopoly in the international supply of technology from private enterprises through Government measures rather than through measures taken by the enterprises themselves is certainly an arduous task. One solution, which it is easier to propose than to apply, would be to modify national legislation and institutions in the industrialized countries in order to limit, in the original country of registration of the patents, the aspects (accepted in the application for registration) which most accentuate or consolidate the monopolistic or duopolistic nature of the supply. This shows how difficult it is to improve the developing countries' weak position in the negotiation of licensing contracts for the technologically newest products or processes without previously or simultaneously modifying the legal and institutional procedures of the industrialized countries so as to make them antimonopolistic or antioligopolistic.

3. Transfer of technology: distribution by
branch of industry

(a) Some descriptive aspects

The breakdown of imported technology by the branch of industry to which it is destined varies according to whether the data refer to the number of contracts or to the size of remittances in foreign currency paid in respect of the transfer of technical know-how and the right to use trademarks and patents. The very nature of this difference reveals an important feature of the transfer process in Brazil, namely, the wide variation in average payments per contract from one branch of industry to another.

The basic industries, which mainly produce capital goods and intermediate products (metallurgy, chemicals, mechanical engineering, electrical and communications equipment, transport equipment, and pharmaceutical products and medicines) accounted for 73 per cent of contracts for the transfer of technology that were in force on 31 December 1969. The remaining 27 per cent went almost entirely to the various consumer goods industries.

IPEA's subdivision of the main branches of industry listed in the IBGE classification is of immediate interest as regards imported technology: the iron and steel industry continues to lead the field, while the pharmaceutical and textiles industries show a relative increase. Table 5 further confirms the highly concentrated manner in which contracts are distributed, especially when the picture is broken down into the subsectors that utilize most external technology. For example, 12 subsector, out of a total of 43, account for 1,107 contracts (two-thirds of the total number of contracts in force), while the remaining 31 subsectors account for only 558 contracts.

Turning now to the payments made by the same branches of activity, but with reference only to the more detailed IPEA classification, table 6 shows the distribution of external remittances in respect of technical know-how in 1969, by branch of industry and in decreasing size of outflow from each branch. The figures given are expressed in cruzeiros at 1969 current prices and in dollars after conversion at the average rate of 4.00 cruzeiros to the dollar, and refer solely to branches of industry whose payments were over 500,000 dollars.

The table illustrates the sharp change in the relative importance of the various branches of industry as users of imported technology when measured in terms of payments.

The motor industry alone - which covers only the manufacture of vehicles, and not the parts and components industries - accounts for almost half the payments made, and for 55.3 per cent if electrical and non-electrical motor vehicle parts are included. All the other branches, including the iron and steel industry, come far lower down the scale.

Table 4

DISTRIBUTION OF CONTRACTS ACCORDING TO THE CLASSIFICATION BY
MAIN BRANCHES OF ACTIVITY ESTABLISHED BY THE BRAZILIAN
GEOGRAPHICAL AND STATISTICAL INSTITUTE
(IBGE)

Branch of activity (in decreasing order of the number of contracts registered)	Total number of contracts	Percentage
Metallurgy	308	18.50
Chemicals	204	12.27
Mechanical engineering	202	12.13
Electrical and communications equipment	193	11.60
Transport equipment	178	10.69
Pharmaceutical and medicinal products	130	7.80
Textiles	108	6.48
Non-metallic minerals	76	4.56
Miscellaneous	69	4.15
Plastic products	35	2.10
Food products	32	1.92
Toilet preparations, soaps and candles	25	1.50
Paper and paperboard	22	1.32
Beverages	20	1.20
Rubber	19	1.14
Clothing and footwear	18	1.08
Wood, furniture, printing industry, tobacco, hides and skins	26	1.56
<u>Total</u>	<u>1 665</u>	<u>100.00</u>

Source: IPEA.

Table 5

DISTRIBUTION OF CONTRACTS ACCORDING TO THE CLASSIFICATION OF THE
INSTITUTE FOR ECONOMIC AND SOCIAL PLANNING (IPEA)

Branch of activity	Number of contracts	Percentage
Iron and steel industry and iron and steel products	188	11.29
Pharmaceutical and medicinal products	130	7.80
Textiles	108	6.48
Mechanical engineering products in general	103	6.19
Motor vehicle parts	97	5.83
Metallurgical products in general	76	4.57
Electrical equipment in general	74	4.45
Petrochemical raw materials and other organic materials	72	4.33
Elastomers, detergents and other end products	71	4.27
Miscellaneous	69	4.15
Inorganic products, including fertilizers	61	3.67
Electrical apparatus and appliances for the home	58	3.49
Remaining products contained in IPEA classification	558	33.50
<u>Total</u>	<u>1 665</u>	<u>100.00</u>

Source: IPEA.

Table 6.

DISTRIBUTION OF EXTERNAL PAYMENTS IN RESPECT OF THE TRANSFER
OF TECHNICAL KNOW-HOW IN 1969

Branch of industry according to IPEA classification	Payments in respect of the transfer of technology		
	Thousands of cruzeiros	Thousands of dollars	Percent- age
Vehicles	99 041	24 760	46.3
Non-electrical parts for the motor vehicle industry	16 605	4 151	7.8
Iron and steel industry and iron and steel products	8 746	2 186	4.1
Food products	8 726	2 181	4.1
Pharmaceutical and medicinal products	8 715	2 178	4.1
Electrical apparatus and appliances for the home	7 450	1 862	3.5
Rubber	7 101	1 775	3.3
Textiles	5 999	1 500	2.8
Electrical equipment in general	5 385	1 346	2.5
Cement and cement products	4 801	1 200	2.2
Glassware	4 745	1 186	2.2
Inorganic products, including fertilizers	4 440	1 110	2.1
Paper and paperboard	2 986	747	1.4
Non-ferrous metals	2 932	733	1.4
Electrical parts for the motor vehicle industry	2 558	640	1.2
Petrochemical raw materials and other organic materials	2 550	637	1.2
Mechanical engineering products in general	2 006	502	0.9
<u>Total</u> (including other unspecified sectors)	<u>214 080</u>	<u>53 520</u>	<u>100.0</u>

Source: Based on IPEA data.

/Particularly interesting

Particularly interesting is the smallness, both in absolute and relative terms, of payments for imported technology made by the industries producing pharmaceutical products and organic and inorganic chemicals. It should also be pointed out that table 6, which only shows sectors whose remittances were over 500,000 dollars in 1969, does not include such important sectors (from the standpoint of the economy and of the technological modernization of the entire industrial production resources) as the manufacture of machine-tools and other industrial machinery and equipment in general. All in all, the manufacture of machinery and equipment represented no more than 1.6 per cent of total remittances in respect of the transfer of technology in 1969, and payments by the machine-tool industry were absolutely insignificant (70,000 cruzeiros, or 17,500 dollars).

These contrasts are highlighted in table 7, which compares the distribution of payments for the period 1965-1969 and the number of contracts, giving the average payment per contract during the period and listing the branches of industry according to the IPEA classification, in decreasing size of average payment.

The result is not quite the same as that of the two previous tables, since taking all payments for 1965 to 1969 as a whole alters the picture because of the variation in the relative importance of each sector during the period. For example, the relative share of such sectors as the iron and steel industry and non-ferrous metals declined, while during the same period payments for imported technology by other sectors, such as chemicals and food products, tended to increase. The same was true of electrical appliances and motor vehicle parts, though the actual manufacture of motor vehicles did not follow the same upward trend. In fact, remittances by the motor vehicle industry (excluding the manufacture of parts and components) fluctuated widely between 1965 and 1969 (from 46.7 per cent to 15.8 per cent of the total in 1965 and 1967 respectively) but did not apparently show a sufficiently definite trend during the period to reduce their relative share in total remittances in respect of the transfer of technical know-how for industry 21/.

(b) Average payments per contract

Table 7 shows the relative position in 1965-1969 and the average amount of remittances per contract for the entire period, in branches of industry listed in decreasing size of average payment. These payments are expressed at 1969 prices and refer only to branches of industry whose average payments represent 50 per cent or more of the overall industrial average.

21/ These observations are based on IPEA data which are not shown here.

Table 7

RELATIVE POSITION AND AVERAGE SIZE OF REMITTANCES
PER CONTRACT DURING THE PERIOD 1965-1969 a/

(Values in cruzeiros at 1969 current prices)

Branch of industry	1965-1969 payments (Thousands of cruzeiros)	Number of contracts	Average remittance per contract (Thousands of cruzeiros)	Relative figures
Vehicles	212 000	22	9 636	1 703
Rubber	26 754	10	2 675	473
Printing enterprises	7 777	6	1 296	229
Non-ferrous metals	22 902	18	1 272	225
Food products	34 008	29	1 173	207
Transformers	5 037	5	1 007	178
Electrical apparatus and appliances for the home	29 516	39	757	134
Cement and cement products	16 591	22	754	133
Electrical motors	5 126	7	732	129
Glassware	13 456	19	708	125
Non-electrical parts for the motor vehicle industry	46 728	80	584	103
<u>All sectors</u>	695 303	1 229	566	<u>100</u>
Pharmaceutical and medicinal products	38 940	78	499	88
Communications equipment	4 980	10	498	88
Domestic transport equipment	5 752	12	479	85
Inorganic products, including fertilizers	16 798	41	410	72
Petrochemical raw materials	19 352	49	395	70
Iron and steel industry and iron and steel products	55 544	142	391	69
Tobacco	1 119	3	373	66
Textiles	28 661	79	363	64
Machinery for road works	4 274	12	356	63
Electrical parts for the motor vehicle industry	8 947	28	320	57
Miscellaneous	15 497	49	316	55
Electrical equipment in general	16 778	54	311	55
Paper and paperboard	4 962	16	310	55

Source: Based on IPEA data.

a/ Including only branches of industry whose average remittances represent 50 per cent or more of the average for all branches of industry.

/Not counting

Not counting the manufacture of motor vehicles, which once again leads all branches of industry, the order of the remaining industries in terms of average payments per contract differs radically from that of previous tables. For example, following the motor vehicle industry, whose remittances per contract are seventeen times the average for the whole of manufacturing industry, come the rubber and printing industries, along with others which did not even appear in previous tables. One striking feature is the low relative figure (lower than the overall average for industry) for remittances by the pharmaceutical and medicinal products, petrochemical and other organic raw materials, and iron and steel industries. The average payment per contract made by the latter is almost the same as that of the textile industry. This probably derives from the fact that in the iron and steel industry technical assistance contracts do not cover all or even most of the operations of a given enterprises, the usual system in the past being to have a large number of contracts - 142 - each covering a highly specific aspect of a particular process, an aspect of an extension programme, or merely temporary assistance for solving a certain operational problem.

Variations from one sector to another (both as regards the frequency with which enterprises make use of external technology and as regards the volume of payments in respect of imported know-how and the average size of payments per contract) prove that expenditure on imported technology by each sector of industry does not correspond to the intrinsic technological complexity of the sector but is determined by a large number of complicated factors that are virtually impossible to identify from the empirical data available. Two observations are in order.

In the first place, the technological complexity of a given branch of industry does not necessarily mean that demand for external technology will be that much higher. If the sector is fairly sluggish or actually contracting its demand for technology will be insufficient to justify importation. The clearest case of this is perhaps Brazil's machine-tool industry, to which reference is made at greater length in chapter VIII of this study 22/.

Secondly, there are different forms of remuneration according to the category of technology concerned. As IPEA observes, it is natural that payments in respect of external technology should be higher in branches of industry where licence concessions and technical assistance contracts are generally paid for on the basis of production than in those that prefer to utilize technology imported under contracts allowing for a fixed sum to be paid once only (engineering services, project design, etc.). This distinction may partly explain the small volume of technology imported into Brazil by very modern sectors operating at a fairly complex technological level, such as those producing industrial machinery and equipment (excluding machine-tools).

22/ See ECLA, "The transfer of technical know-how in the machine-tool industry in Brazil" (E/CN.12/920), September 1971.

(c) Cost of technology by branch of industry

It is tempting to speculate on the cost of external technology to the various sectors concerned, despite the shortage of empirical data to which the IPEA study repeatedly draws attention, and table 8, which relates payments for imported technology to the value of production of each branch of industry according to the IBGE classification, attempts to do precisely this. The table shows separately the evolution of this ratio for two types of technology: type I, covering technical assistance, manufacturing licences and the use of patents and trademarks and type II which includes engineering services and project design. The difference between the two lies in the permanency or duration of the technological collaboration offered (the totals do not include the petroleum products industry).

The ratio between payments for the use of external technology and the value of production of manufacturing industry as a whole (excluding petroleum products) rose by 50 per cent between 1966 and 1968, taking both types of technology together. Taken separately, technical assistance implying ties of a more permanent nature (technical assistance contracts and licences of various kinds) increased fairly steadily during the period, while temporary technical assistance rose by about 70 per cent in 1967 (compared with November 1966) but dropped sharply in 1968. The major importance of payments for the first type of technology is reflected in a similar variation for imported technology as a whole.

The significance of this increase is obvious. On the one hand, it points to a greater dependence on imported technology in a general and somewhat vague sense, while on the other hand it can also be interpreted as the outcome of the gradual change in the relative proportions of inputs utilized in Brazil's industrial output, since the larger expenditure on external technology could well be accompanied (and compared in production costs) with a parallel reduction in other costs (raw materials, power, manpower, etc.) as a result of the progressive modernization of production processes. However, considering that the variables used here are highly aggregated and that the analysis covers such a short period (thereby rendering it difficult to detect a trend towards modernization which, by its very nature, is a long process), it may be that the hypothesis of such a rapid substitution of factors of production is not sufficiently supported by the data. The increase in the ratio of external payments for transferred technology to the value of production could easily be the outcome of the introduction of new products and new processes into the economy, regardless of any modernization of existing activities. Naturally, the introduction of new products and the modernization of manufacturing processes are taking place simultaneously, and it must be stressed that the sharp upward trend between 1966 and 1968 (the short period covered by the available data) can perhaps be better explained by the introduction of new products which of themselves require more refined and more expensive techniques (in certain chemical industries, for instance), than by a more generalized move towards imported technology. Other IPEA data on the number of enterprises with contracts for the transfer of technology and on the distribution of these contracts by branch of industry tend, however to discredit such a hypothesis.

Table 8

INDEX OF THE EVOLUTION OF THE RATIO BETWEEN PAYMENTS
IN RESPECT OF THE TRANSFER OF TECHNOLOGY AND THE
VALUE OF PRODUCTION BY BRANCH OF ACTIVITY,
1966-1968

(1966 = 100)

Branch of industry	Type I		Type II		Total	
	1967	1968	1967	1968	1967	1968
Non-metallic minerals	213	350	100	117	195	210
Metallurgy	186	129	155	109	167	117
Mechanical engineering	140	220	-	100	140	230
Electrical and communications equipment	121	191	140	20	123	169
Transport equipment	113	142	700	400	124	146
Wood	-	-	100	150	100	150
Furniture	100	100	-	-	100	100
Paper and paperboard	-	100	-	100	-	100
Rubber	102	58	-	-	100	57
Hides and skins	100	200	-	-	100	200
Chemicals	223	92	900	500	271	121
Pharmaceutical and medicinal products	228	181	-	-	228	181
Toilet preparations soaps and candles	54	11	-	-	54	11
Plastic products	240	220	100	200	217	217
Textiles	109	87	-	-	109	73
Clothing and footwear	100	40	-	-	100	40
Food products	100	600	50	50	75	325
Beverages	-	100	100	300	100	400
Tobacco	100	71	-	-	100	71
Printing industry	-	100	-	100	-	100
Other	52	61	120	100	57	64
<u>Total</u>	<u>127</u>	<u>153</u>	<u>167</u>	<u>133</u>	<u>133</u>	<u>150</u>

Source: IPEA; IBGE.

/As regards

As regards the ratio between external payments and the value of the product by branch of manufacturing industry, the highest ratios occur in the beverage and food industries, followed by mechanical engineering, non-metallic minerals, plastic products and chemicals. This order of precedence, in which the consumer goods industries that depend very much on marketing stand out from the rest, possibly owes its origin largely to a more intensive use of registered trademarks. The ratio for pharmaceutical and medicinal products dropped between 1967 and 1968, following a sharp increase in 1967, as did that of the metals industry (iron and steel and non-ferrous metals). In the case of fixed capital goods (electrical, communications and transport equipment), the increase in the ratio was closer to the average figure for industry as a whole and remained so during the two years under consideration.

(d) Size of enterprises

Finally, one of the tabulations of the IPEA study ^{23/} sheds some light on the influence of the size of the enterprise on the use of external technology, since it shows that, in industry as a whole, there is no significant relationship between the two. Only in three branches of industry (metallurgy, transport equipment and chemicals) is this relationship high (out of the 20 largest enterprises in each cases, 18, 17 and 15 enterprises respectively have contracts for the transfer of technology). However, even here there is no particular concentration of imported technology in the biggest enterprises, since the 18, 17 and 15 enterprises with contracts account for only 24 per cent (metallurgy), 30 per cent (transport equipment) and 20 per cent (chemicals) of the total for the enterprises in the sector receiving external technology under contract. In other words, the largest enterprises in the sectors referred to nearly always have technology contracts, but the pattern is not peculiar to the largest, since most of the contracts with external sources of technology were taken out by the remaining, smaller enterprises.

Only 10 of the 20 biggest mechanical engineering enterprises and 6 of the 20 largest pharmaceutical and medicinal products enterprises have this kind of external contract.

(e) Transfer of technology according to the economic function of the products

The classification of contracts according to the economic function of the goods produced that used by IPEA uses in its tabulations covers

^{23/} Not included here for reasons of space.

/the following

the following categories: (i) capital goods, (ii) intermediate goods, (iii) consumer durables, (iv) non-durable consumer goods and (v) motor vehicle components.

The classification naturally poses certain difficulties, not just because of the shortage of data but also because of the very nature of these industries, where goods that belong to different categories are often produced within the same establishment. The most obvious example is motor vehicle parts, which may be classified either under capital goods (trucks and other utility vehicles) or under consumer durables (private automobiles); they were accordingly placed in separate categories 24/.

It was observed that most current contracts have to do with the manufacture of capital and intermediate goods, which together account for 62 per cent of the 1,665 contracts in force on 31 December 1969, while the percentage of contracts relating to non-durable consumer goods (20 per cent) is higher than that for consumer durables (9 per cent). This is probably partly because contracts relating to the mere use of trademarks are fairly numerous and more common in industries producing non-durable consumer goods, and also because these industries are spread over a considerable number of enterprises, whereas the consumer durables industry, on the other hand, is in the hands of a smaller number of larger enterprises producing a wide range of products (such as electrical appliances for the home and other articles made from metal).

Finally, in the period 1954-1969, the number of contracts by type of use of the goods produced declined sharply after 1967, 245 contracts being registered in that year, 134 in 1968 and 52 in 1969. This probably reflects the application of stricter criteria for the approval of contracts by government authorities in the latter years. The clearest trend seems to be an increase in the number of contracts for the manufacture of intermediate goods, owing to the considerable expansion in recent years of basic industrial sectors producing raw materials for industry.

4. The sectoral structure of imports of technology and industrial strategy

The data on the distribution of contracts and payments among various branches of industry examined in the foregoing section clearly illustrate the lack of criteria for importing technology in line with a sectoral development strategy, subject to the previous assessment and authorization of contracts submitted by enterprises. The initiative for concluding a contract for external know-how and choosing the outside source and method of transfer (technical assistance, process licences, etc.) is left to the enterprise itself, with the federal authorities

24/ The information which follows is taken from the IPEA study and refers to tables which are not given here.

merely checking that the contract's duration, the remuneration and other terms (particularly those which might restrict the freedom of action of the enterprise in a way that could be prejudicial to it or to the country) conform to the few legal and administrative provisions that are in force. In fact, it could hardly be otherwise, since there is no sectoral development strategy to guide the authorities as to the types of technical know-how most suitable for enterprises and industrial sectors and enable them to assess and choose among the licence and technical assistance contracts submitted to them, encouraging certain initiatives or in other cases persuading enterprises to reformulate particular aspects of their original proposals.

It is tempting to compare the sectoral structure of imports of technology in Brazil and in Japan and to conclude that the main difference between the two countries in this respect is that more Japanese contracts go to the capital goods industries, which in turn contribute most in the way of exports of manufactures. This factor could thus be the key to Japan's strategy in respect of imported technology: a sectoral concentration geared to the sectoral objectives of a strategy for the export of manufactures of increasing technological complexity ^{25/}. This subordination of technological imports to a selective export promotion policy would seem to have been accompanied by a great deal of applied and technological research (the ratio of domestic expenditure on research and development to expenditure on imports of technology under licence agreements and similar systems is apparently four to one).

This interpretation of Japanese policy is very interesting, but does not seem to fit in sufficiently with the relevant data. Moreover, the mere transposition of Japan's technological imports policy to Brazil would scarcely be feasible in the short and medium term. These two points are briefly examined below.

The comparison of the sectoral distribution of imported technology in Brazil and in Japan from which the above parallel is drawn is based on an analysis of the number of contracts for the transfer of technology and not on the payments to which they give rise. It has already been seen that the sectoral distribution of contracts in Brazil differs widely from that of payments on account of the tremendous variation in average payments per contract from one industrial sector to another (see section 3 (b) of this chapter). The data for Japan are taken from the study conducted by Oldham, Freeman and Turkcan, to which references has already been made and which refer not to the distribution of payments among industrial sectors but to the number of contracts. It is therefore in order to ask how this affects the comparison. It is probable that it makes a considerable difference, as there is little likelihood that Japan has the same extremely marked variation in average payments per contract as Brazil, in so far as foreign enterprises

^{25/} See F. Fajnzylber, op. cit., p. 160 et seq.

/(and especially

(and especially international companies) are far less prevalent in Japan than in Brazil and as the highest average payments in Brazil are to be found in industrial sectors where foreign enterprises predominate (see section 6 of this chapter, below). This raises some doubt as to the significance of the comparison between the sectoral distribution of imports of technology in Brazil and in Japan.

Furthermore, the study's assertion that Japan has systematically geared its imports of technology and technological processes to the sectors producing capital goods is also open to question, especially in the sweeping form in which it is made 26/. On the contrary, one of the most striking aspects of a retrospective analysis of Japan's industrial policy is precisely the fact that, for a long time, certain capital goods industries (machine-tools, textile machinery and other production machinery) made hardly any effort to fill domestic needs and did little, therefore, to import technology or encourage technological research and development. Most of the capital goods of these industries, both nowadays and during Japan's period of rapid industrialization, are imported, although they serve a wide range of industries such as mechanical engineering and textiles, which are major sources of exports. This may in fact be the explanation of the apparent paradox. In the case of the electrical equipment and textiles industries which were considered an important source of exports for Japan and therefore needed to be highly competitive, the authorities (and enterprises) found it to their advantage to use imported machinery and postpone import substitution so as to benefit in the meantime from the great technological advance of Western suppliers and the keen competition for the world market that existed among them 27/. All this, of course, is relative, not absolute. Japan did not completely disregard the manufacture of capital goods; it merely selected those it wished to produce. It was, however, precisely in the manufacture of machinery for industry (as opposed to the manufacture of machinery for other purposes, such as power generation, maritime and rail transport equipment, etc.) that Japan showed a rather faltering development for many decades which only picked up momentum in recent years. It would therefore seem difficult to accept without reservations a Japanese strategy for the importation of technology combined with an expansion of exports, as described, and recommend its application to Brazil.

26/ Such is the impression given by such works as William W. Lockwood, The economic development of Japan: Growth and structural change 1868-1938 (Princeton 1954). This differing point of view receives further support from the study made by the Japanese National Commission for UNESCO, Technological development in Japan (mimeographed, 1968), particularly in chapters III and IV.

27/ See the works mentioned in the previous footnote.

Furthermore, Brazil does not have a strategy for the export of manufactures with clear-cut sectoral targets. Its export promotion strategy for manufactures, the basis of which has certainly been laid 28/, does not lay down any priority criteria for selecting incentives that will help achieve specific targets, whether by sector or by product. Indeed, it could scarcely be otherwise, since the introduction of the element of selection, which is indispensable for the implementation of policies geared to the established sectoral objectives, would come up against serious practical and theoretical difficulties. The element of selection would have to derive from the fixing of export quotas with which industries would have to comply, from the adoption of abstract criteria (such as the "proportion of value added" or "labour intensiveness") to distinguish between the various sectors of industry when introducing incentives, or else from the identification of sectors deemed to be export-oriented by virtue of their position in a scale of "comparative advantages" 29/. To a greater or lesser degree, all these procedures seem fairly ineffective, quite apart from the serious practical problems that their implementation would pose (this point is taken up again in the following chapter). Consequently, targets and selection criteria to improve and complete Brazil's strategy for the export of manufactures should be introduced on the basis not of abstract criteria such as these, but of a sectoral industrial strategy whose objectives and export targets would form part of an integrated set of provisions constituting

28/ For the nature and content of a strategy for the export of manufactures, see, for example, three studies submitted to the Meeting of Experts on the Formulation and Implementation of Strategies for the Export of Manufactures, held in Santiago from 27 July to 4 August 1971: Franklin R. Root, "Conceptual models for export promotion strategies at the national and enterprise levels" (ST/ECLA/Conf.37/L.6); William A. Dymsha, "Export strategy: formulation and implementation"; (ST/ECLA/Conf.37/L.11) and Fernando Fajnzylber, "Considerations for the formulation of strategies for exports of manufactures" (ST/ECLA/Conf.37/L.28). Despite the varying meanings attached to the expression "strategy for the export of manufactures" and the fact that strategies of this kind cannot be entirely explicit, there clearly seems to exist a common denominator or "minimum content". A comparison of the various measures, provisions and policies used in Brazil to promote exports, particularly of non-traditional products (especially manufactures), suggests that these policies and institutions, taken as a whole, do indeed constitute a definite strategy, though not yet in its final form since many of its components still have to be developed and completed. The limitations imposed by the central theme of this study prevent the point being analysed in greater detail here.

29/ The last criteria mentioned is examined in an article by Antonio Carlos Rocca, "Elementos para una política de diversificação de exportações", Estudos APEC (Rio de Janeiro, Brazil).

a modern policy that could bring faster growth to the industrial sectors that are most important from the economic standpoint (generation of product) and from the social standpoint (distribution of personal, functional, regional or geographic income). The task of devising a realistic and effective industrial policy seems of prime importance at present and will certainly be a step towards the formulation of a strategy for the export of manufactures and a policy for the transfer of external technology in line with other objectives.

5. Transfer of technology by type of technical know-how

The five categories of technical know-how considered in this section are those defined in chapter III (section 5):

- (a) Technical assistance;
- (b) Licences for manufacturing or for the use of patents, or both;
- (c) Licences for the use of trademarks;
- (d) Engineering services;
- (e) Project preparation.

When the distribution of contracts according to the type of technology transferred and the total number of contracts are considered, it is observed that technical assistance contracts are the most common (810 or 48.7 per cent), followed by engineering services (316 or 18.9 per cent), licences for the use of trademarks (244 or 14.7 per cent, licenses for manufacturing or for the use of patents, or both (191 or 11.5 per cent), and project preparation (104 or 6.2 per cent). An analysis of payments likewise points to the predominance of technical assistance contracts, which accounted for 68 per cent of total external payments under the heading of technology transfer between 1965 and 1969. Table 9 summarizes these data.

As we shall see below, the high percentage of technical assistance contracts - and of payments for the same item - is probably explained to a large extent by the fact that this is the method generally used by foreign firms for the transfer of technical know-how from their parent companies or from other foreign firms owned by those parent companies, because the legislation in force in Brazil does not permit them to register contracts for licences to manufacture or for the use of patents or trademarks.

Table 9

DISTRIBUTION OF CONTRACTS BY NATURE OF TECHNOLOGY TRANSFERRED

	Technical assistance	Manufacturing licences	Licences for the use of trade marks	Engineering services	Project preparation
Number of contracts	810	191	244	316	104
Percentage of number of contracts	48.7	11.5	14.7	18.9	6.2
Percentage of payments made during period 1965-1969	68.0	9.0	6.1	12.2	4.7

Source: IPEA.

Table 10 and 11 show the distribution of the five categories over the various branches of industry. The first table refers to contracts, and the second to payments.

A comparative analysis of tables 10 and 11 enables some observations to be made on the sectoral distribution of the technology transferred.

(a) Technical assistance contracts predominate as a mode of technology transfer - in number and percentage distribution - in the following branches of industry:

	<u>Percentage</u>
Electrical products and household electrical appliances	74.1
Rubber goods	73.7
Mechanical products in general	71.8
Tractors and agricultural machinery	69.2
Communications equipment	66.7
Machine tools	66.6
Diesel and petrol engines, pumps and compressors	65.8
Electrical equipment in general	62.1

/Table 10

Table 10

PERCENTAGE DISTRIBUTION OF CONTRACTS FOR TRANSFER OF TECHNOLOGY,
BY TYPE OF TECHNOLOGY AND BRANCH OF INDUSTRY

Branch of industry	Type of technology		Licences for the use of trade-marks	Engineering services	Project preparation	Total
	Technical assistance	Manufacturing licences or licences for the use of patents				
Glass	43.5	21.8	13.0	13.0	8.7	100.0
Cement and articles made from cement	36.0	12.0	-	48.0	4.0	100.0
Non-metallic goods in general	60.7	14.3	3.6	7.1	14.3	100.0
Iron and steel manufacture and products	15.4	3.2	1.6	66.5	13.3	100.0
Forgin and casting	37.5	6.3	12.5	25.0	18.7	100.0
Non-ferrous metallurgy	25.0	-	-	35.7	39.3	100.0
Metallurgical products in general	59.2	15.8	14.5	6.6	3.9	100.0
Machine tools	66.6	6.7	20.0	-	6.7	100.0
Diesel and petrol engines, pumps and compressors	65.8	7.9	21.0	5.3	-	100.0
Machinery, parts and components for the textile industry	57.1	28.6	14.3	-	-	100.0
Tractors and agricultural machinery	69.2	7.7	23.1	-	-	100.0
Internal transport equipment	57.9	15.8	21.0	5.3	-	100.0
Engineering products in general	71.8	10.7	14.6	2.9	-	100.0
Electrical components for the automobile industry	66.7	-	33.3	-	-	100.0
Electric motors	55.6	11.1	11.1	11.1	11.1	100.0
Transformers	40.0	10.0	20.0	10.0	20.0	100.0
Electrical articles and electrical household appliances	74.1	8.6	12.1	3.5	1.7	100.0
Communications equipment	66.7	16.7	8.3	8.3	-	100.0
Electrical equipment in general	62.1	12.2	10.8	12.2	2.7	100.0
Non-electrical components for the automobile industry	58.8	18.6	17.5	4.1	1.0	100.0
Vehicles	57.8	11.5	19.2	11.5	-	100.0
Road-building equipment	62.4	18.8	18.8	-	-	100.0
Railway equipment	61.1	27.8	11.1	-	-	100.0
Transport equipment in general	52.4	9.5	9.5	23.8	4.8	100.0
Timber	14.3	-	-	71.4	14.3	100.0
Furniture	42.9	42.9	14.2	-	-	100.0
Paper and paperboard	31.8	4.5	-	45.5	18.2	100.0
Rubber goods	73.7	10.5	5.3	10.5	-	100.0
Hides and skins	66.7	-	-	33.3	-	100.0
Inorganic products, including fertilizers	24.6	8.2	4.9	36.1	26.2	100.0
Products for the plastics and resins industry, synthetic fibres, elastomers, detergents and other end-products	50.7	12.7	16.9	12.7	7.0	100.0
Petrochemical raw materials and other organic materials	43.0	11.1	5.6	26.4	13.9	100.0
Pharmaceutical and medicinal products	61.6	11.5	25.9	-	-	100.0
Toilet preparations, soaps and candles	52.0	12.0	36.0	-	-	100.0
Plastic products	51.5	17.1	17.1	11.4	2.9	100.0
Textiles	37.3	13.8	25.8	21.3	1.8	100.0
Clothing and footwear	44.4	16.7	33.3	5.6	-	100.0
Foodstuffs	50.0	9.4	6.2	25.0	9.4	100.0
Beverages	15.0	5.0	20.0	55.0	5.0	100.0
Tobacco	33.3	66.7	-	-	-	100.0
Publishing and printing	33.2	16.7	16.7	16.7	16.7	100.0
Miscellaneous	43.6	15.9	27.5	10.1	2.9	100.0
<u>Total</u>	<u>48.7</u>	<u>11.5</u>	<u>14.7</u>	<u>18.9</u>	<u>6.2</u>	<u>100.0</u>

Source: IFEA.

Table 11

PERCENTAGE DISTRIBUTION OF PAYMENTS FOR TRANSFER OF TECHNOLOGY,
BY TYPE OF TECHNOLOGY AND BRANCH OF INDUSTRY

Type of technology Branch of industry	Technical assistance	Manufacturing licences or licences for the use of patents	Licences for the use of trade-marks	Engineering services	Project preparation	Total
Glass	45.0	18.7	0.0	18.6	17.7	100.0
Cement and articles from cement	41.2	8.3	-	41.7	8.8	100.0
Non-metallic goods in general	89.5	8.3	0.3	0.9	1.0	100.0
Iron and steel manufacture and products	22.7	2.0	0.7	64.9	9.7	100.0
Forging and casting	50.5	29.6	3.1	5.0	11.8	100.0
Non-ferrous metallurgy	12.4	-	-	38.0	49.6	100.0
Metallurgical products in general	41.7	24.9	10.8	13.1	9.5	100.0
Machine tools	94.9	3.5	-	-	1.6	100.0
Diesel and petrol engines, pumps and compressors	75.0	1.6	23.4	-	-	100.0
Machinery, parts and components for the textile industry	74.8	22.3	2.9	-	-	100.0
Tractors and agricultural machinery	74.3	6.1	19.6	-	-	100.0
Internal transport equipment	97.1	1.3	1.4	0.2	-	100.0
Engineering products in general	65.6	9.5	15.8	9.1	-	100.0
Electrical components for the automobile industry	92.0	-	8.0	-	-	100.0
Electric motors	26.5	24.5	24.5	0.0	24.5	100.0
Transformers	25.3	24.9	24.9	-	24.9	100.0
Electrical articles and electrical household appliances	80.9	6.7	7.2	0.9	4.3	100.0
Communications equipment	57.8	22.7	13.6	5.9	-	100.0
Electrical equipment in general	74.7	15.5	6.7	2.7	0.4	100.0
Non-electrical components for the automobile industry	61.5	15.0	22.6	0.9	0.0	100.0
Vehicles	87.4	4.5	4.5	3.6	-	100.0
Road-building equipment	97.8	1.1	1.1	-	-	100.0
Railway equipment	70.4	26.8	2.8	-	-	100.0
Transport equipment in general	79.2	-	2.6	16.4	1.8	100.0
Timber	4.4	-	-	54.1	41.5	100.0
Furniture	84.0	15.3	0.7	-	-	100.0
Paper and paperboard	78.6	0.7	-	15.6	5.1	100.0
Rubber goods	98.4	0.0	1.4	0.2	-	100.0
Hides and skins	96.7	-	-	3.3	-	100.0
Inorganic products, including fertilizers	19.9	17.9	11.7	29.4	21.1	100.0
Products for the plastics and resins industry, synthetic fibres, elastomers, detergents and other end-products	25.2	59.7	5.4	5.3	4.4	100.0
Petrochemical raw materials and other organic materials	55.3	24.6	0.9	10.0	9.2	100.0
Pharmaceutical and medicinal products	92.7	2.2	5.1	-	-	100.0
Toilet preparations, soaps and candles	59.6	6.2	34.2	-	-	100.0
Plastic products	70.0	3.4	16.7	9.9	-	100.0
Textiles	44.1	40.6	11.5	3.4	0.4	100.0
Clothing	94.5	1.5	3.6	0.4	-	100.0
Foodstuffs	75.0	2.0	1.5	20.9	0.6	100.0
Beverages	11.2	0.1	2.0	67.5	19.2	100.0
Tobacco	43.7	56.3	-	-	-	100.0
Publishing and printing	97.3	0.0	0.0	0.7	2.0	100.0
Miscellaneous	80.1	0.9	3.6	14.6	0.8	100.0
Total	68.0	2.0	6.1	12.2	4.7	100.0

Source: IPEA.

/(b) However,

(b) However, the distribution by branches of industry is very different when the payments made during the period 1965-1969 are considered. The following branches are the most important purchasers of technical assistance:

	<u>Percentage</u>
Rubber goods	98.4
Road-building equipment	97.8
Publishing and printing	97.3
Internal transport equipment	97.1
Hides and skins	96.7
Machine tools	94.9
Clothing and footwear	94.5
Electrical components for the automobile industry	92.0
Vehicles	87.4

(c) With regard to the transfer of external technology under manufacturing licences or licences for the use of patents, or both, the number of contracts and the corresponding payments are highest, within the total corresponding to each of the five categories of transfer in the following industries:

	<u>Percentage of contracts</u>	<u>Percentage of payments</u>
Tobacco	66.7 %	56.3 %
Furniture	42.9	15.3
Machinery and components for the textile industry	28.6	22.3
Railway equipment	27.8	26.8
Elastomers, detergents and other end-products	12.7	59.7

These branches of industry are made up essentially of domestic or independent enterprises and can hence resort to this type of technology transfer. However, the same branches also have technical assistance agreements which account for a sizeable share of their total payments for technology. Thus, for instance, in the tobacco industry 43.7 per cent of the remaining payments in respect of technology imports correspond to technical assistance agreements, in the manufacture of machinery and components for the textile industry the proportion of payments for technical assistance is 74.8 per cent of total payments for the transfer of technology, and in the railway equipment industry the corresponding proportion is 70.4 per cent.

/(d) The

(d) The branches of industry that make the biggest use of licenses for trademarks are the following:

	<u>Percentage of contracts</u>	<u>Percentage of payments</u>
Toilet preparations and similar products	36.0 %	34.2 %
Clothing and footwear	33.3	3.6
Electrical parts for the automobile industry	33.3	8.0
Pharmaceutical and medicinal products	26.9	5.1
Textiles	25.8	11.5
Tractors and agricultural machinery	23.1	19.6
Internal transport equipment	21.0	1.4
Diesel and petrol engines, pumps and compressors	21.0	23.4
Machine tools	20.0	-
Household electrical goods	20.0	7.2
Transformers	20.0	24.9
Vehicles	19.2	4.5

As can be seen from the foregoing, the relative position of the different branches as regards the use of trademarks shows considerable variation according to whether the payments or the number of contracts are considered. This highlights once again the enormous disparities that exist between one branch of industry and another with regard to the amount of remuneration provided for in the contracts. As regards the payments made, the above list should be expanded by the addition of electric motors and non-electrical parts for the automobile industry, which also account for a high percentage of total payments (24.5 and 22.6 per cent, respectively).

The proportion of payments made for the use of trademarks is generally quite modest, even in those branches of industry which are intrinsically more dependent on this type of technology transfer. This reflects the growing severity of the policy on registration of contracts applied by the Central Bank and other authorities in recent years.

It should also be pointed out that the generalized and intensive use of trademarks is not restricted to industries producing consumer goods but also extends to various capital goods industries.

Lastly, it should be noted that the presence of data on payments for licences for the use of trademarks does not mean that no use is made of other modes of importation of technical know-how, especially technical assistance contracts. This is not just the case with sophisticated industries, such as those that produce capital goods, but also with those that use simpler technology that has been available

/in the

in the country for a longer time; these latter industries would appear to be able to do without such assistance, and yet they use it very intensively (judging by the corresponding level of payments). The comparative list which follows illustrates this situation:

	<u>Payments for technical assistance</u>	<u>Payments in respect of licences for the use of trademarks</u>
Toilet preparations, soaps and candles	59.6 %	34.2 %
Textiles	44.1	11.5
Plastic products (final processing industries)	70.0	16.7
Non-electrical parts for the automobile industry	61.5	22.6

(e) In comparison with the above category of transfer, a larger number of industries use a higher proportion of engineering services:

	<u>Percentage of contracts</u>	<u>Percentage of payments</u>
Timber industry	71.4 %	54.1 %
Iron and steel industry and iron and steel products	66.5	64.9
Beverages	55.0	67.5
Cement and articles made from cement	48.0	41.7
Paper and paperboard	45.5	15.6
Inorganic products, including fertilizers	36.1	29.4
Non-ferrous metallurgy	35.7	38.0
Hides and skins	33.3	3.3
Petrochemical raw materials and other organic materials	26.4	10.0
Foodstuffs	25.0	20.9
Forgings and castings	25.0	5.0

It should be pointed out that there are no major discrepancies - except in two of the industries listed - between the percentages characterizing this mode of technology transfer in relation to the total importation of technology by each branch, both as regards the number of contracts and the payments effected.

/(f) In

(f) In contrast, project preparation occupies an important place in fewer industries:

	<u>Percentage of contracts</u>	<u>Percentage of payments</u>
Non-ferrous metallurgy	39.3 %	49.6 %
Inorganic products, including fertilizers	26.2	21.1
Transformers	20.0	24.9
Electric motors	11.1	24.5
Timber	14.3	41.5
Beverages	5.0	19.2

(g) As regards the payments made for technical know-how, the structure of the transfer of technology, by categories, for the industries on which special monographs were prepared was as follows:

PERCENTAGE PAYMENTS

	Technical assistance	Manufacturing licences or licences for the use of patents, or both	Licences for the use of trademarks	Engineering services	Project preparation
Iron and steel	22.7	2.0	0.7	64.9	9.7
Machine tools	94.9	3.5	-	-	1.6
Textiles	44.1	40.6	11.5	3.4	0.4
Clothing and footwear	94.5	1.5	3.6	0.4	-

As domestic and independent enterprises predominate in the above four branches of industry - and it is therefore possible for them to sign licencing agreements for the manufacture of goods or for the use of trademarks - the comparison is not subject to any distortion on account of differences in the ownership of enterprises. It will be observed that the preparation of projects and the hiring of engineering services to solve specific problems has a high incidence only in the iron and steel industry. In contrast the importance of permanent technical assistance for the day-to-day operation of plants is only modest in that industry, and probably declined during the period under review. In the manufacture of machine tools, however, where the incidence of technology imports (measured in absolute terms by the number of contracts and the level of payments) is very modest, technical assistance in the day-to-day operation of plants predominates. The same is true of the clothing and footwear industries. The situation is different in the textile industry which, because of the existence of new manufacturing processes using synthetic and artificial fibres, makes more use of agreements in respect of patented processes and trademarks.

/(h) Lastly,

(h) Lastly, the same comparison is made in respect of two groups of industries, representing the manufacture of capital goods and consumer goods, respectively:

PERCENTAGE PAYMENTS

	Technical assistance	Manufacturing licences or licences for the use of patents, or both	Licences for the use of trade-marks	Engineering services	Project preparation
<u>Capital goods</u>					
Diesel and petrol engines	75.0	1.6	23.4	-	-
Machinery and components for the textile industry	74.8	22.3	2.9	-	-
Tractors and agricultural machinery	74.3	6.1	19.6	-	-
Internal transport equipment	97.1	1.3	1.4	0.2	-
Electric motors	26.5	24.5	24.5	-	24.5
Vehicles	87.4	4.5	4.5	3.6	-
Road-building equipment	97.8	1.1	1.1	-	-
<u>Consumer goods</u>					
Furniture	84.0	15.3	0.7	-	-
Pharmaceutical and medicinal products	92.7	2.2	5.1	-	-
Toilet preparations, soaps and candles	59.6	6.2	34.2	-	-
Textiles	44.1	40.6	11.5	3.4	0.4
Clothing and footwear	94.5	1.5	3.6	0.4	-
Foodstuffs	75.0	2.0	1.5	20.9	0.6
Beverages	11.2	0.1	2.0	67.5	19.2

/In the

In the first place, it will be observed that none of these groups of industries has a characteristic uniform feature distinguishing it from the rest. While technical assistance is increasingly the predominant form of technology transfer in most of the industries, whether producers of capital goods or consumer goods, the increase in the relative share of manufacturing licences and licences for the use of trademarks is clearly linked to a reduction in the technical assistance utilized. This phenomenon is most marked in the field of electric motors and textiles, which are dominated by domestic enterprises. Other industries, such as those manufacturing diesel and petrol engines, pumps and compressors, tractors and agricultural machinery and toilet preparations, soaps and candles, which combine high proportions of technical assistance with manufacturing licences for the use of trademarks probably have mixed structures, i.e., these exist side by side in the same sector subsidiaries or enterprises linked to the licensing firm (which prefer to use technical assistance agreements) and domestic or independent enterprises (which use licensing agreements).

In view of the statutory provisions prohibiting foreign subsidiaries of companies which are based abroad, or firms whose capital is linked to that of the company supplying the technology, from signing contracts for the use of trademarks and patents with the companies in question, it is difficult to establish a correlation between the type of industry and the technology employed, on the one hand, and the preferred modes of technology transfer, on the other. This aspect of the ownership of enterprises is analysed in section 7 of this chapter.

6. Transfer of technology by external origin

The IPEA data on the external origin of technology, which are based on payments effected during the period 1965-1969, indicate that the United States occupied first place, followed closely by the Federal Republic of Germany and then, in decreasing order and with a much lower participation by France, Italy, Switzerland and other unspecified countries of Western Europe (tabulated as a whole), with Japan and Great Britain bringing up the rear (see tables 12, 13 and 14 which contain data from the IPEA study).

However, the relative position of the different countries showed a definite trend during the period 1965-1969 which could soon modify the picture of the external origin of technology purchased by Brazil. In the first place, there is the rapid rise of the amounts paid to the Federal Republic of Germany, in contrast with the decline of payments to the United States between 1968 and 1969. Secondly, there is the relatively steady growth of France's participation. Lastly, mention should be made of the secondary and declining position of Great Britain. In brief, over the period 1965-1969 around one-third of total payments were made to the United States, a similar proportion to the Federal Republic of Germany, and the remaining third was divided among the other countries mentioned.

On the basis of the IPEA data, some interesting conclusions can be drawn with respect to the relationship between the payments made and the number of contracts registered, for each country of origin. The highest average paid per contract during the period 1965-1969 corresponds to the Federal Republic of Germany, being double the average sum paid in respect of contracts with United States enterprises. The ratio of the remuneration to the number of contracts signed with Italy and Japan is also high. For the other countries (including the United States) this ratio is lower than the average for all payments under the heading of transfer of technology.

An examination of the origin of technology by branches of industry (considering the payments made during the period 1965-1969 and excluding the number of contracts) shows the branches in which each country predominates as a source of imported technology 30/.

United States: tobacco (100 per cent), transformers (99.6 per cent) publishing and printing (98.1 per cent), electric motors (97.9 per cent), railway equipment (96.7 per cent), hides and skins (96.7 per cent), internal transport equipment (90.1 per cent).

30/ The information given was taken from tables contained in the IPEA study, which are not included in this work.

Table 12

DISTRIBUTION BY COUNTRIES OF PAYMENTS FOR TRANSFER
OF TECHNOLOGY, 1965-1969

(Thousands of cruzeiros at 1969 prices)

Country	Year					Total
	1965	1966	1967	1968	1969	
United States	12 625	34 520	59 618	64 516	47 296	218 575
Great Britain	945	5 829	9 540	4 933	2 738	23 984
France	6 461	13 102	11 403	9 839	18 158	58 963
Federal Republic of Germany	37 304	28 064	19 800	28 431	102 784	216 383
Italy	4 251	8 402	11 923	10 241	9 994	44 811
Switzerland	0	1 386	8 641	19 882	9 470	39 378
Other countries of Western Europe	919	469	1 397	19 612	11 421	33 818
Japan	19 682	357	1 932	2 938	4 341	29 250
Others	22	6 502	8 920	6 818	7 878	30 140
<u>Total</u>	<u>82 208</u>	<u>98 632</u>	<u>133 173</u>	<u>167 210</u>	<u>214 080</u>	<u>695 303</u>

Source: IPEA.

Table 13

PERCENTAGE DISTRIBUTION BY COUNTRIES OF PAYMENTS FOR
TRANSFER OF TECHNOLOGY, 1965-1969

(Percentages)

Country	Year	1965	1966	1967	1968	1969	Total
	United States		15.4	34.9	44.7	38.5	22.1
Great Britain		1.2	5.9	7.2	3.0	1.3	3.5
France		7.9	13.3	8.6	5.9	8.5	8.5
Federal Republic of Germany		45.3	28.5	14.8	17.0	48.0	31.1
Italy		5.2	8.5	8.9	6.1	4.7	6.4
Switzerland		0.0	1.4	6.5	11.9	4.4	5.7
Other countries of Western Europe		1.1	0.5	1.1	11.7	5.3	4.9
Japan		23.9	0.4	1.5	1.8	2.0	4.2
Others		0.0	6.6	6.7	4.1	3.7	4.3
<u>Total</u>		<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Source: IPEA.

Table 14

DISTRIBUTION BY COUNTRIES OF PAYMENTS AND CONTRACTS FOR
TRANSFER OF TECHNOLOGY, 1965-1969

Country	Payments a/	Number of contracts	Payments (percent ages)	Number of contracts (percent- ages)	Average payments b/	Index
United States	218 575	544	31.4	44.3	401.8	71.0
Great Britain	23 984	82	3.5	6.7	292.5	51.7
France	58 963	125	8.5	10.2	471.7	83.4
Federal Republic of Germany	216 383	207	31.1	16.8	1 045.3	134.3
Italy	44 811	48	6.4	3.9	933.6	165.0
Switzerland	39 378	72	5.7	5.9	546.9	96.7
Other countries of Western Europe	33 818	73	4.9	5.9	463.3	81.9
Japan	29 250	30	4.2	2.4	975.0	172.4
Others	30 140	48	4.3	3.9	627.9	111.0
<u>Total</u>	<u>695 303</u>	<u>1 229</u>	<u>100.0</u>	<u>100.0</u>	<u>565.7</u>	<u>100.0</u>

Source: IPEA.

a/ Value in thousands of cruzeiros at 1969 prices.

b/ Ratio of total payments to total number of contracts.

/Federal Republic

Federal Republic of Germany: machine tools (85.6 per cent), vehicles (83.3 per cent), electrical components for the automobile industry (76.8 per cent).

France: textiles (70.3 per cent), toilet preparations and similar articles (52 per cent).

Italy: rubber goods (96.5 per cent).

Switzerland: furniture (58.9 per cent).

Japan: machinery and components for the textile industry (79.8 per cent), non-ferrous metallurgy (61.5 per cent).

Other Western European countries: communications equipment (63.9 per cent).

It is also interesting to note the origin of imported technology (on the basis of the payments made) in those branches of industry that were examined in special monographs, and in certain other branches which are of particular importance for the economic development of the country.

Iron and steel: United States (37.5 per cent), Japan 21.5 per cent, France (14.1 per cent), Federal Republic of Germany (13.1 per cent).

Machine tools: Federal Republic of Germany (85.6 per cent), United States (7.4 per cent), France (7 per cent).

Machinery for the textile industry: Japan (79.8 per cent), United States (8.7 per cent), Federal Republic of Germany (7 per cent), Italy (3.7 per cent).

Vehicles: Federal Republic of Germany (83.3 per cent), United States (14.4 per cent), Italy (1.7 per cent), France (0.6 per cent).

Electrical components for the automobile industry: Federal Republic of Germany (76.8 per cent), United States (21.3 per cent), United Kingdom (1 per cent).

Non-electrical components for motor vehicles: United States (50.6 per cent), France (24.1 per cent), Federal Republic of Germany (6.3 per cent).

Paper and paperboard: United States (82.5 per cent), other Western European countries (10.4 per cent), Italy (2.1 per cent).

Inorganic chemicals: Federal Republic of Germany (48.4 per cent), United Kingdom (19.6 per cent), France (12.4 per cent).

Petrochemical raw materials: United Kingdom (35.8 per cent), United States (34.7 per cent).

Petrochemical products: United Kingdom (63.3 per cent), United States (18.5 per cent), Federal Republic of Germany (7.4 per cent).

Textiles: France (70.3 per cent), United States (26.3 per cent).

Foodstuffs: Switzerland (52.9 per cent), United States (39.6 per cent).

The above data appear to show that, in Brazil, imports of technical know-how are largely dictated by the prevailing pattern of international specialization with regard to the technological development of the different branches of industry.

A comparison with the results of UNCTAD study mentioned earlier ^{31/} can be taken as a basis for this conclusion: The main disparities observed in comparing the structure of world technology imports with those of Brazil are the lesser relative importance of the United Kingdom as a source of technology imported by Brazil (average for 1965-1969) and the greater relative importance of Japan and other countries, excluding those of Western Europe.

7. Transfer of technology, by categories of enterprise ownership

Three categories of enterprise ownership are considered in this section: domestic firms, foreign subsidiaries or affiliates of firms based abroad, and independent foreign firms, that is, firms which have no links with enterprises based abroad ^{32/}.

^{31/} See Oldham, Freeman and Turkcan, op. cit., page 12 and table 1, and ECLA, "Sistema industrial y exportación de manufacturas: Análisis de la experiencia brasileña", op. cit., page 158 (table 5.2). In the latter, the structure of world technology imports in 1964, estimated in the UNCTAD work, is compared with the structure of Brazilian imports of technology between 1965 and 1968.

^{32/} It should be borne in mind that this classification was made exclusively in the light of the destination of payments provided for in contracts. In the present study a foreign company, even though it is a subsidiary of a parent firm based abroad, is regarded as independent for the purposes of the analysis if the contract or contracts signed by it are with other foreign firms independent of its parent firm.

Although under Brazilian law a foreign firm is one in which at least 50 per cent of the capital belongs to individuals or corporate entities domiciled abroad, the IPEA study applied a different criterion - explained above - for the tabulations, setting a minimum foreign capital holding of only 30 per cent.

This classification was designed not only to help discover how much (or how little) access there is to technology developed abroad, through the internal channels of firms with international connexions, but also to permit an analysis which would take account of the fact that when the contracting parties belong to the same international organization, the remuneration for technical know-how laid down in contracts does not necessarily reflect the real value of the technology transferred. In such cases, it is fair to accept that there is a possibility that the remunerations provided for in contracts for the transfer of technical know-how mainly represent transfers of financial resources between international organizations. Moreover, the IPEA study states that, from the point of view of the international enterprise, only the amount of overall receipts is of interest. Thus, the composition of financial remittances considered in the light of profits on the capital invested and payments for the transfer of technology depends basically on the institutional and juridical treatment of foreign capital and the transfer of technology by the recipient country. Consequently, the mechanism described above is a possible source of distortions when it is attempted, through the analysis of contracts, to identify the technical know-how incorporated into the Brazilian system of production 33/.

The results of the analyses based on the information collected by IPEA on the differences between the payments made by different types of enterprises during the period 1965-1969 are very important and appear in tables 15 and 16.

Table 15

DISTRIBUTION OF PAYMENTS FOR TRANSFER OF TECHNOLOGY,
BY CATEGORIES OF ENTERPRISE OWNERSHIP, 1965-1969

(Thousands of cruzeiros at 1969 prices)

Enterprise	Year	1965	1966	1967	1968	1969	Total
	Domestic		34 310	25 583	44 780	42 381	37 204
Foreign	Subsidiary affiliate or both	45 704	58 690	44 925	70 854	135 720	355 893
	Independ- ent	2 193	14 360	43 468	53 975	41 156	155 151
	Total	47 897	73 050	88 393	124 829	176 876	511 044
	TOTAL	82 207	98 632	133 173	167 210	214 080	695 303

Source: IPEA

33/ IPEA op. cit.

/Table 16

Table 16

PERCENTAGE DISTRIBUTION OF PAYMENTS FOR TRANSFER OF TECHNOLOGY,
BY CATEGORIES OF ENTERPRISE OWNERSHIP, 1965-1969

Enterprises	Year	1965	1966	1967	1968	1969	Total
	National		41.7	25.9	33.6	25.4	17.4
	Subsidiary, affiliate, or both	55.6	59.5	33.7	42.4	63.4	51.2
Foreign	Independent	2.7	14.6	32.6	32.3	19.2	22.3
	Total	58.3	74.1	66.3	74.7	82.6	73.5
	<u>TOTAL</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Source: IPEA.

/The information

The information contained in these tables may be summarized as follows:

(a) Roughly three-quarters of the payments were made by foreign firms.

(b) The participation of foreign firms grew during the period from 58 per cent in 1965 to 83 per cent in 1969.

(c) The major part of the payments made by foreign firms was accounted for by subsidiaries or affiliates of firms based abroad. These firms made more than half the payments recorded during the period, whereas the number of contracts signed by independent foreign firms was less than the number signed by domestic firms. The proportion of the total payments for the transfer of technology accounted for by remittances from subsidiaries, affiliates, or both, in respect of the importation of technology from their parent companies, fluctuated widely during the period under review, reaching its highest level in 1969 (63.4 per cent).

(d) On the other hand, very different results are obtained when the number of contracts in force is broken down according to ownership of enterprises. The distribution shows that the average size of payments per contract depends largely on the ownership links between the contracting parties. Thus, the average payments made by subsidiaries or affiliates, or both, to parent companies are eight times higher than the payments made by domestic enterprises and more than four times higher than those made by foreign firms that have no links with the company providing the technology. The data relating to the average of total remittances are as follows:

	<u>Average remittance expressed as an index</u>
Domestic firms	45.2
Independent foreign firms	82.1
Subsidiaries or affiliates of foreign-based firms	361.6
All three categories of firms	<u>100.0</u>

Source: Data compiled by IPEA.

(e) With regard to the distribution by branches of industry and ownership of enterprises, the data indicate that remittances made by domestic enterprises predominate in the following sectors 34/:

34/ This study does not include the basic data on this distribution, which were also taken from the IPEA study.

/Percentage

	<u>Percentage</u>
Tractors and agricultural machinery	100.0
Railway equipment	100.0
Timber	100.0
Furniture	100.0
Beverages	96.3
Non-ferrous metallurgy	95.9
Iron and steel	92.7
Forging and casting	84.9

(f) Foreign subsidiaries or affiliates, or both, and independent enterprises accounted for a major proportion of remittances in the following sectors during the period under review:

	<u>Percentage</u>
Transformers	100.0
Vehicles	100.0
Tobacco	100.0
Rubber goods	99.5
Electric motors	97.8
Publishing and printing	97.1
Hides and skins	96.7
Clothing and footwear	94.3
Machine tools	92.7

(g) Foreign enterprises, whether subsidiaries or independent firms, predominate in 29 of the 42 branches of industry included in the IPEA classification, and account for more than 50 per cent of the payments made for the transfer of technology in each branch of industry.

(h) Lastly, the figures indicate that the level of payments is generally higher in those sectors which are dominated by foreign enterprises, particularly when these are subsidiaries and/or affiliates of firms based abroad, both as regards absolute figures and the average paid per contract. If the average payments made by the three categories of enterprise are expressed in relative figures, taking the average level of payments made by all enterprises as a basic index equal to 100, it is observed that the average remuneration under the heading of technology transfer by domestic enterprises amounts to 45 per cent of the overall average, that of independent foreign firms to 82 per cent, and that of foreign subsidiaries and/or affiliates to 36 per cent of the average taken as the base of comparison.

/(i) The

(i) The relationships between enterprise ownership and the nature of the contract, that is, the mode of transfer adopted in industry as a whole or in specific branches, can only be analysed on the basis of data on the number of contracts, since there is no similar information based on the analysis of the payments or remittances effected in respect of the contracts. Of the 1,665 contracts in force among all the enterprises importing technology, 810 corresponded to technical assistance, 191 to manufacturing licences/and or licences for the use of patents, 244 to licences for the use of trademarks, 316 to engineering services and 104 to project preparation. In this case, working in terms of the number of contracts, the concentration of technical assistance in foreign firms is not so great as when measured in terms of payments, since the average payments per contract are much higher in the case of foreign firms, and especially in the case of subsidiaries of foreign firms, as we have already seen.

(j) Table 17 shows the breakdown of the number of contracts according to enterprise ownership and mode of transfer in the iron and steel, machine tool and textile industries.

Some provisional conclusions that can be drawn from these data are examined in the next chapter, but two general aspects are worth mentioning here. The first concerns the different levels of relative participation by domestic and foreign enterprises in each sector of industry. At first sight, greater participation by foreign investment should be reflected in lower expenditure on external technology, since the investment itself is usually a valuable instrument for the transmission of technical know-how from abroad, quite apart from licensing agreements or technical assistance contracts, although obviously such know-how is not provided free of charge but is paid for through the return on the capital invested. Moreover, Brazilian law prohibits the signing of licensing agreements for the use of product or process patents and trademarks between enterprises based in Brazil and their respective parent firms abroad or other enterprises dependent on the latter. Despite this, as we have seen, the existing relationship is quite different, since payments for external technology are highest in those branches of industry which are dominated by foreign firms.

The second aspect, which is not unconnected with the first, is the constantly declining importance of domestic enterprises in the process of transfer of external technology.

Some interpretations (or speculations) in respect of these two aspects are presented in the following chapters and particularly in the last chapter.

Table 17

DISTRIBUTION OF CONTRACTS, BY CATEGORIES OF ENTERPRISE OWNERSHIP AND MODES
OF TRANSFER, IN THE STEEL, MACHINE TOOL AND TEXTILE INDUSTRIES

Mode of transfer	Ownership of enterprise and branch of industry														
	Domestic			Subsidiary, affiliate, or both			Inde- pendent			Total			Grand total		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Technical assistance	23	5	26	1	1	5	5	4	9	6	5	14	29	10	40
Manufacturing licences or licences for the use of patents, or both	6	-	7	-	-	3	-	1	5	-	1	8	6	1	15
Licences for the use of trademarks	2	2	25	-	-	1	1	1	2	1	1	3	3	3	28
Engineering services	111	-	18	3	-	-	11	-	5	14	-	5	125	-	23
Project preparation	24	1	2	-	-	-	1	-	-	1	-	-	25	1	2
<u>Total</u>	<u>166</u>	<u>8</u>	<u>78</u>	<u>4</u>	<u>1</u>	<u>9</u>	<u>18</u>	<u>6</u>	<u>21</u>	<u>22</u>	<u>7</u>	<u>30</u>	<u>188</u>	<u>15</u>	<u>108</u>

Source: IPEA

- (1) Steel industry
- (2) Machine tool industry
- (3) Textile industry

Chapter VI

SOME CONSIDERATIONS REGARDING A POLICY ON ENTERPRISE-TO- ENTERPRISE AGREEMENTS

Because of its review of the mechanisms at present in existence for the transfer of technology through agreements between enterprises and their operation in recent years, the IPEA study ^{1/} constitutes a basis for the critical examination of these mechanisms and the analysis of some possibilities for reformulating them. This chapter will consider the criticisms of and suggestions for improving existing mechanisms, and some comments will be added to the conclusions of the study.

1. General conclusions drawn from the analysis of contracts and concessions of patents

The IPEA study draws some main conclusions of a general nature, based on the analysis of the information available on contracts registered and financial remittances abroad.

(a) In the first place, it is observed that there is a considerable degree of technological dependence on the exterior which varies appreciably from sector to sector but is always substantial; the study emphasizes the probability that this situation will become even more pronounced, in view of the limited domestic potential for technological activity and the fact that the technological requirements of the national system of production are of a degree of complexity which is increasingly beyond the country's own scientific and technological creative capacity.

The IPEA study therefore asserts that there is a double increase in imbalance: an increase is to be observed in the "absolute imbalance" between domestic technology and the latest innovations assimilated into the world reservoir of technological know-how, while there is a similar increase in the "relative imbalance" between domestic demand and supply of technology ^{1/}.

This observation emphasizes the magnitude of the problems and obstacles standing in the way of the internal dissemination of technology, i.e., the dissemination of the most advanced techniques (best-practice techniques) in each sector and in each manufacturing process through the industry of the country, starting from the centers which receive the imported technology (usually individual enterprises). In fact, since this "absolute imbalance"

^{1/} IPEA, A transferência de tecnologia no Brasil, op. cit.

(to use the IPEA expression refers to the "average" level of technology throughout the country (and therefore in each sector of economic activity), it is linked with the degree of "technological homogeneity" achieved. If the raising of the general technological level of a particular sector of industry - even considering only those technical aspects in which the new processes or products depend closely on the exterior - had to depend exclusively, or even principally, on imports of techniques from abroad, the problem of the "transfer of technology" would assume extraordinary dimensions, both as regards the capacity of absorption demanded from the enterprises most unfavourably situated as regards their own basis of technology, finance and scale of operations, and as regards the outflow of foreign exchange arising from the huge flow of financial remittances needed to pay for the inevitable large-scale importation of technology. To avoid or lessen these problems, it is indispensable to have available mechanisms and institutions to promote the internal dissemination of techniques imported by the various means employed as part of national policy in general and industrial policy in particular.

It may likewise be suggested that the "relative imbalance", i.e., the imbalance between the domestic demand and supply of technology, is equally closely linked to the above problem.

The reasons for this assertion may be summed up in the conclusion, reached in the course of other studies, that an important requisite for increasing the volume of activities and efficiency of official or para-official research institutes is that they should be linked with permanent and systematic "industrial extension" work, i.e., assistance to industry in the technological aspects of its operation and in the improvement of its internal organization. This gives grounds for assuming that the "differences" are not in fact independent of each other, and that among the necessary features is the structuring of an efficient system of technical assistance to industry covering the whole country, so as to reduce the average technological imbalance vis-à-vis the exterior and to increase national activities in applied research and technological development.

(b) The IPEA's second general observation is that the transfer policy must be based on reasonably accurate knowledge regarding the technological requirements of the system of production and the potential for a national generation of science and technology; it also points out the difficulties and risks of giving one standard global type of treatment to imports of technological know-how. The need to consider the different applications to import technology individually, each on its own merits, would, of course, require an institutional structure sufficiently flexible to allow for the separate evaluation of each individual case.

In explaining this point of view, IPEA draws attention to the "technological heterogeneity" of the national system of

/production and

production and points out the existence of a technologically dynamic sector, which assimilates innovations relatively rapidly, alongside another sector which is technologically stagnant, as is shown by the absence of any changes in its processes of production. This would make it necessary for the evaluation to be carried out with a considerable degree of discrimination, since within a single branch of industry technologically dynamic and technologically stagnant units can often be found co-existing 2/.

This last point shows that special treatment is required for each case, i.e., for each enterprise or contract, rather than a policy defined in different terms for each branch or sector of industry. Such special treatment would be aimed not only at providing the authorities with more accurate and detailed information on each case, thus allowing decisions to be taken individually with regard to each enterprise and facilitating the application of the respective financial and tax conditions, on the basis of previously established criteria of national priority, but would also constitute an instrument of selection which would determine the increase in the demand for research work submitted to the national technological institutes 3/.

The proposal to replace a system like the present one, which contains a certain amount of automaticity 4/, by machinery providing for a strictly individual appraisal of each contract on the basis of criteria of national priority and also considerations relating to the setting up of a "reserved market" for the national research institutions, is very important, and should be given careful consideration in order to avoid any repetition of the disadvantages observed in the structure of industry as a result of the import substitution policy.

IPEA is not unaware of this type of risk, nor of the need to complement the technology transfer policy applied to the dynamic enterprises and to the enterprises of the "stagnant" area with clear-cut measures in other areas of government policy, since the document produced by the IPEA working group mentions the need to devise technology transfer policy in such a way as to integrate it with the measures aimed at modernizing the system of production and the efforts to increase the research potential of the country.

2/ IPEA, op. cit., pp. 71 and 72.

3/ Mention may be made here of the new document by the industrial sector of IPEA, Potencial de Pesquisa Tecnológica no Brasil, June 1971.

4/ Despite the ample margin of decision left open to the Central Bank by the regulations in force as regards negotiation with the contracting parties (referred to in other sections of this chapter and already discussed in chapter IV).

It goes on to say, however, that the dynamism (of the sector which is not technologically stagnant) should be analysed so as to differentiate the cases due to the use of imported technical know-how from those due to internal technological research, but even here the aim of diminishing technological dependence on the exterior should not be pursued through a policy which restricts imports of technology 5/.

The crux of the problem lies precisely in what type of combination or complementation is to be sought between industrial development policies, technology transfer policies, and scientific and technological development policies. In the present state of institutional development in Brazil, it might not perhaps be possible to go very far at the moment in attempts to formulate and apply a group of integrated industrial development policies designed to control the importation of technical know-how and the development of scientific discovery and national technology, with a view to leading Brazil to a much higher degree of "technological independence" in the short or medium term. This aim should, however, be pursued, although it depends largely on the initiatives which have produced and co-ordinated the market mechanisms. A policy designed to restrict imports of technical know-how and direct the demand for such know-how towards national substitutes sources is only possible, within less narrow limits, when there are well-defined sectoral development strategies (as regards quantitative goals of production and investment, scales, etc.), and also machinery for influencing the official technological institutes and for securing permanent and effective relations between these institutes and industry. Some advances have been made in Brazil in this respect in recent years, but not sufficient for thinking in terms of the general restriction of imports of technical know-how as a means of developing the generation of technology in Brazil itself and its application through industry.

Lastly, as regards the individual and detailed evaluation of each contract for the importation of foreign technical know-how, another point may be mentioned, which is more a doubt than an objection. This point is whether it would be possible to build up in a federal civil service agency, through the large group of highly specialized staff which would be needed, the sum of technological know-how necessary for a detailed dialogue with enterprises, and indispensable for the evaluation and judicious solution of all the cases which might arise.

(c) The third general appraisal made in the IPEA study concerns the participation of foreign-based enterprises located in Brazil in imports of technology.

5/ IPEA, op. cit., p. 72.

The different treatment given to national enterprises and foreign enterprises acquiring foreign technical know-how should be analysed from two points of view: capacity and power of negotiation and remuneration for the technology transferred.

As regards negotiating power, the lack of entrepreneurial preparation for negotiations on imports of technical know-how is mentioned. This lack occurs, of course, in different degrees, ranging from ignorance of the technological needs of the enterprises to simple lack of information as regards the availability of foreign technical know-how and the existence of alternative sources. At all events, however, the lack of entrepreneurial preparation always means a diminution of the negotiating power of the national enterprise. This diminution is all the more serious when the broadness of the limits between which the remuneration for the transferred technology may be fixed renders the payments to be made under the contract extremely sensitive to the negotiating power of the parties concerned. It is therefore the duty of the government bodies in charge of technology transfer policy to aid national entrepreneurs with the information and advisory services necessary to strengthen their negotiating power 6/. Foreign enterprises would not require this type of support, according to the IPEA study, since in addition to being presumably generally more efficient, they have better access, through their parent firms, to information concerning the international supply of technical know-how, to say nothing of the importance which the parent firms often have as a source of innovations and of technical know-how in general. According to the study, this support would constitute another argument in favour of special treatment of contracts for the importation of technology.

The considerations of the IPEA as regards the need to provide the national entrepreneur with advisory services on the identification, negotiation and importation of the technology needed to build up his enterprise are fully justified. As this need and the importance of technological advice in negotiations with foreign firms is clear, attention need be drawn only to two questions of a practical nature. One of these is the feasibility of restricting such support to national enterprises, since not all foreign enterprises are on a large scale or possess all or most of the facilities already mentioned which are generally available to foreign enterprises which form part of major international groups. Various studies on the industrial development of Brazil cite cases of foreign enterprises with a low level of efficiency and a limited scale of operations. Indeed, reference is made to this in the study on the machine-tool industry which forms part of this series 7/. Secondly, the considerable vagueness

6/ IPEA, op. cit.

7/ See ECLA, E/CN.12/920, op. cit.

surrounding the concept of what is a foreign enterprise should be taken into account (this aspect comes out very clearly in the IPEA study), as this is another factor which could be an obstacle to the strict limitation of national enterprises to advisory services for seeking and negotiating for foreign technology.

As regards foreign enterprises, considerations of the remuneration paid for the transfer of external technology likewise suggest that separate treatment would be appropriate, because, in the words of the IPEA study, the payment laid down in contracts between foreign parent firms and their branches or associates does not always reflect the real value of the technology imported. In this case, possible distortions are not due to limited negotiating capacity, but rather to the fact that the remuneration is agreed upon between units belonging to one and the same international organization. From this point of view, the funds transferred under the contract for importing technology seem to depend primarily on the decisions of the international enterprise as regards the allocation and transfer of resources between its different units is concerned, thus giving rise to the possibility that payments for the import of technical know-how include remittances of profits by the branch to the parent enterprise or to some other associated enterprise.

The conclusion of the IPEA study on this problem is that this aspect of the import of technology strengthens the argument for setting up an institutional structure sufficiently flexible to provide advisory services and a control system in respect of these imports which will take each case separately. The study also suggests that although a policy for the transfer of technology may be formulated separately from the national science and technology policy, it should be integrated with the legal system governing the treatment of foreign capital 8/.

The general conclusions quoted and commented upon above form a framework which conditions the specific and detailed suggestions offered by the IPEA working group. These considerations, presented in two complementary plans for application in succession, include in the first plan suggestions which may be applied and implemented within the present institutional structure and are intended to give a greater degree of rationality to the importation of technology and make control measures more effective. In the second plan, it is proposed to reformulate the actual institutional structure responsible for technology transfer policy, by setting up a special body, forming an integral part of the national scientific and technological complex, to be responsible for formulating and implementing policy and also "evaluating" each specific transfer

8/ IPEA, op. cit.

"project" and even taking a direct part in the negotiation of contracts 9/. The aims and area of action of this proposed body are set out and commented upon in the final section of this chapter.

2. Rules for registration and control and categories of transfer

The general thinking behind the group of suggestions concerning the non-financial side of the transfer of technology is that these suggestions should include only the measures and procedures which can be implanted and implemented within the present institutional structure responsible for controlling imports of technology. According to this thinking, the proposed modifications should represent a step towards the implantation of a system designed to review each case individually. This is considered necessary in view of the concern to preserve or even increase the relative flexibility and the relatively broad powers of negotiations which have been available to the federal executive agencies as regards the evaluation and settlement of the final terms of the contracts.

In the first place, there is the question of the registration and control of contracts for the importation of technology. This control is established by law (mainly to verify that the technical assistance contracted for is actually supplied), but its practical implementation is difficult and precarious because of the inadequacy of the institutional structure governing the control of the transfer of technology, which prevents the full achievement of the potential benefits of special treatment.

It is recommended in this respect that applications for the registration or extension of contracts should be reviewed by the technical bodies responsible for technological policy, with a view to verifying the technical and economic need for the transfer of the technology figuring in the contracts and determining the possible links between the national and foreign contracting parties.

The report makes a further recommendation. The above procedure is at present being followed, although not systematically, through the transmission by the Central Bank, to the executive groups of the Industrial Development Council (CDI), of various applications for the renewal of contracts. Although the Council is not really the appropriate agency for this type of review, its participation in the evaluation of imported technology does, of course, represent an advance in comparison with the previous state of affairs. Consequently, within the present system, this procedure should be extended to new registrations, and applicants should be required to

9/ Ibid.

present "projects for the importation of technology", with a view to aiding the task of the competent agency in analysing the merits of the contracts 10/.

A reservation of great importance, but which will give rise to difficult problems on careful consideration, may be added here. The efficacy of the new formalities will depend on the establishment of general criteria for the evaluation of priorities, based on national technology policy, to serve as a guide for those reviewing the requests in each specific case (Central Bank and CDI) 11/.

It may be asked how general criteria can be formulated for the evaluation of priorities on the basis of national technology policy. This is a useful question to ask when studying the possibility of converting the recommendation for the establishment of such criteria into a practical proposition which can be carried out without excessive difficulties.

Without wanting to be dogmatic, it must be admitted that the implementation of the recommendation seems hardly feasible in practice. These criteria would probably be related with the degree of technological advance, either in the absolute sense (i.e., in relation to the industrialized countries) or in the relative sense (i.e., in comparison with the techniques prevailing in the country and sector in question); with the proportion of factors in the techniques imported; and with the possibility of meeting the demand for technology in question from national supply, either already in existence or still to be promoted. This system would be mainly for taking care of requirements arising in connexion with applications for registration of patent concessions or technical assistance contracts; the setting up of new sectors or branches of industry regarded as having top priority in a policy of industrial development or "technological advance"; or the degree of "essentiality" to be assigned to a sector or product which is to be manufactured, within a specific industrial development strategy, etc. The difficulty lies in two main problems: priority criteria, of whatever type, which are derived from a national technology policy presuppose the earlier or simultaneous formulation of an industrial development policy, of which the technological policy should be to a large extent a mere reflection, for technology is not an end in itself, but only a means of achieving specific aims of economic and social development through a specific industrialization strategy, manifest or not. Without the formulation at an adequately detailed level of these aims of industrial development and economic and social development in general, the formulation of a national technological policy capable of giving rise to a series of criteria

10/ Ibid.

11/ Ibid.

of operational value and reasonably automatic application does not seem to be in the least viable. Indeed, an illusion of viability here could be dangerous, in that it could block market mechanisms and hinder the exercise of entrepreneurial options, without replacing them with substitute mechanisms of greater, or at least equal, efficiency.

The problem could arise from the tendency which would probably emerge - although this might not be the original intention when these measures were approved - from an undue emphasis on purely technological factors to the detriment of economic-type factors (whether of a social nature, or merely related to private economic viability, which is irrelevant to the present discussion). This tendency has its disadvantages, an eloquent example of this being the problem of selecting techniques for the equipping and re-equipping of the textile industry, discussed in chapter VIII of this paper. If such a tendency does exist, due to preferential recourse to capital subsidies as the predominant method used to promote the industrial development of the country, it would obviously increase in intensity with the creation of an organization mainly devoted to the transfer of technology, with only a tenuous link with other agencies working in other areas - scientific and technological development, industrial development and general economic policy.

The conclusion arrived at on the basis of the foregoing observations is not that there is no need to institutionalize more completely the transfer of foreign technology, but that such institutionalization should be an integral part of the formulation of an industrial policy. Furthermore, the criteria which should be applied in considering applications to import technology should stem from a sectoral-type industrial policy, i.e., one formulated in respect of each branch or sector of industry. This question will be taken up again in the next chapter.

Lastly, still in connexion with the non-financial aspects of the transfer of technology, the IPEA study observes that one of the greatest weaknesses of the present legislation lies in the failure to distinguish clearly between the different categories of the transfer of technology. The absence from the law (this refers to Law No. 4390) of precise definitions of the categories of transfer of technology is a factor in limiting the possibilities of control and complicating the evaluation of quality and the adjustment of the

level of payment for imported technology. In view of this, the IPEA working group proposes that the following five categories should be given legal status 12/:

- (a) Permanent technical assistance;
- (b) Temporary technical assistance;
- (c) Concessions of the right to use patents in respect of production techniques;
- (d) Concession of the right to use trademarks;
- (e) Complete investment projects.

It is to be observed that contracts in respect of administrative assistance are not considered to be transfers of technology, when they confer on natural or legal persons domiciled, resident or based abroad the operational control of units of production (or a particular part of these) which would otherwise have been controlled by directors or administrators designated by the proprietors. If express reference is made to specific administrative services, however, these contracts are classified as technical assistance contracts (permanent or temporary) 13/.

3. Problems relating to the financial aspects of the transfer

The main aspects to be distinguished here are: the limit of remittances permitted; the duration of remittances; the rules regarding remittances from branches of foreign enterprises to their parent firms, and the taxation (income tax) on remittances for the transfer of technology. Chapter IV described the legislation and current practices for each of these aspects, which will therefore not be repeated here, except where necessary for an appropriate understanding of the criticisms and suggestions made.

Remittances to pay for the transfer of technical know-how are, strictly speaking, limited only indirectly, through the income tax laws. The situation differs, however, depending on whether the firms involved are foreign enterprises established in the country or domestic enterprises. In the former case, while the legal restriction only affects the possibility of making deductions from income tax (up to a maximum of 5 per cent of the gross income from products manufactured or sold), there exists in principle the

12/ These categories are defined in chapter III of this paper and are the same as were adopted in the tables of contracts and payments relating to enterprise-to-enterprise agreements in force on 31 December 1969 (see chapter V).

13/ IPEA, op. cit.

possibility of making remittances to pay for technology in excess of this limit, by considering the excess sums as profits remitted abroad, and taxing them as such 14/. Obviously, this possibility does not exist for domestic enterprises, which do not remit profits abroad.

This possibility for foreign enterprises is purely theoretical, however, since on the basis of the legislation relating to income tax deductions, the authorities of the Central Bank have, in fact, taken on the role of negotiators, with the result that the contracts approved generally include maximum limits for remittances in payment for technology, not exceeding the tax deduction percentages (it should be remembered that these percentages, established by Decree No. 436 of the Ministry of Finance, vary from 1 to 5 per cent, according to the categories of essentiality defined by the same decree in which the products figure). This situation is offset by the fact that the current legislation sets no limits on remittances of profits abroad. Thus, while there does exist a limit on remittances in payment of the transfer of technology, there is, in fact, no restriction on remittances of profits on invested capital 15/.

In a system of remittances as "open" as this, the IPEA working group finds disadvantages which derive on the one hand from the conviction that the "imperfections" in the world market supplying technical know-how, together with the inadequate negotiating capacity of domestic entrepreneurs, raise the costs of imported technology excessively, and on the other hand from the view that, when the technology transfer contracts are drawn up between enterprises belonging to one and the same international group, the cost of the technology actually depends on the internal policy of that group, i.e., remittances in payment for imported technology often really represent transfers of resources within international organizations 16/.

14/ As regards the rates applicable, see section 6 of chapter IV.

15/ IPEA, op. cit. The IPEA study also observes that only in the case of foreign capital invested in the production of goods and services for luxury consumption does Law No. 4390 lay down limits for the remittance of profits abroad (3 per cent of the capital registered). This restriction is apparently not applied in practice, however, for lack of the requisite accompanying regulations. There is a progressive tax on remittances of profits, in place of the fixed rate of taxation of 25 per cent payable on remittances of royalties and similar payments in respect of technology transfer contracts registered in the Central Bank.

16/ IPEA, op. cit.

The solution indicated by the IPEA study would be to prevent this by imposing limits on the remittances, but this would be meaningless or ineffective, since unless government policy on rights and obligations in respect of foreign capital were reformulated, remittances of greater value than the fixed limits would continue to be possible, if they were expressly designated as profits on invested capital 17/.

In the opinion of the IPEA group, of the recommendations which could be applied within the current legal and institutional structure, only a revision of the maximum limits fixed by the Decree No. 436 of the Ministry of Finance for deductions from declarations of income tax would remain as a possibility. Although it is not explicitly stated, the general tenor of the recommendations suggests that this revision would be in the direction of a reduction of the maximum limits and the restructuring of the different categories of goods and their respective percentages, in terms of a re-ordering of product and sector priorities more in line with the prevailing economic and social development strategy.

As regards the limits on remittances, it is proposed that the percentages referred to should not be based on the gross value of production, but on the value added, so as to avoid an increase in payments abroad due to the repeated basing of the respective remittances not only on finished products but also on raw materials and components, when imported technology enters into all these.

Lastly, as regards industrial products and technical advisory services, the Central Bank is adopting a special assessment procedure whereby the level of remuneration established in the contract is evaluated in terms of the total resources mobilized for the project in which foreign consultants are participating. The remuneration requested by the latter is also evaluated on the basis of information obtained from the Fund for the Financing of Project and Programme Studies (FINEP) on the level of salaries normally paid by the international consultant firms.

As regards the duration of remittance payments, the objections are largely similar to those mentioned above in connexion with the limits on remittances, and stem from the same cause: there are only indirect restrictions imposed through the law on income tax. Law No. 4390 does not establish maximum durations for remittances in respect of technology transfer contracts, and despite the fact that only the first five years of the contract are valid for the purposes of income tax (in exceptional cases this period may be extended for a further five years), these contracts can lead to the payment of

17/ Ibid.

remittances for an unlimited period, provided that these payments are designated and taxed as payments of profits.

The IPEA study suggests that the periods for which tax deductions may be made should be reviewed, and that periods differing in accordance with the complexity of the technology transferred should be laid down. This latter recommendation is supported by the conclusions of the ECLA study on the machine-tool industry, already mentioned, which points out the detrimental effect of the uncertainty regarding the renewal of the initial five-year period authorized by the Central Bank when negotiating concessions for the manufacture of products and the use of very complex and very new processes.

As for the rules governing remittances in respect of contracts between branch firms and their parent firms abroad, current legislation only permits transfers in payment of technical assistance contracts (of the various types already mentioned), and forbids the payment of royalties for the use of trademarks and patents for the manufacture of products or the use of processes.

According to the IPEA study, this prohibition is of doubtful effectiveness, firstly because when no restrictions exist on technical assistance contracts between parent firms and branches and there is no check on the actual technical assistance which has been contracted for, it is sufficient to avoid any reference in the text of these contracts to trademarks and patents for it to be possible to send remittances for them, while secondly the definition of a branch of a foreign enterprise - i.e., a legal person established in the country, at least 50 per cent of whose voting capital belongs, directly or indirectly, to the enterprise whose headquarters is abroad - does not classify in this category many Brazilian enterprises which are controlled by foreign investors, even though the latter have less than 50 per cent of the voting capital, and moreover contracts are often drawn up between an enterprise established in the country and a foreign enterprise which is different from that which has shares in the Brazilian enterprise, but nevertheless belongs to the same international organization 18/.

The solution proposed in order to deal with the aspects mentioned consists in analysing each case by setting up appropriate institutional machinery; this is dealt with in section 5 of this chapter.

18/ Ibid.

As regards the fiscal treatment of the remittances of foreign exchange in connexion with the transfer of technology, reference has already been made to the current legal provisions, which limit indirectly the possibility of making remittances by fixing the percentage of the gross income from products sold and manufactured which may be deducted in income tax declarations, and by taxing as profits the part which exceeds this percentage 19/.

The objections put forward in this respect may be summed up as follows: the percentage deduction in the income tax declarations should be based only on the value added (and not on the gross value of production), while the scale laid down by Decree No. 436 of 1958 for the deductions which may be made should be revised and modified. According to the IPEA study, this modification should take the form of a reclassification of industries to take into account the degree of essentiality of the technology imported, and differentiation should also be made according to the type of technology transferred, the form or mechanism used for the transfer, and the duration of the remittances.

In the first respect, it is suggested that the highest priority should be given (hence permitting larger deductions) in the case of contracts which, in addition to introducing new technology into the countries, fulfil one or more of the following requisites:

- (a) Promote the production of goods where the domestic supply does not satisfy demand;
- (b) Promote the production of goods necessary for the development of other productive activities;
- (c) Make possible the utilization of raw materials or industrial components which are plentiful in the domestic market;

19/ Ibid. Another important aspect which does not figure in the IPEA study should be added, namely, the separate system applied to foreign enterprises which are branches of other firms (i.e., which are not independent) as regards the deductions which may be made in estimating the net income of legal entities. In the case of such enterprises, deductions in respect of remittances for technical assistance contracts are not permitted, i.e., it is not permitted to deduct such remittances as costs in the income declaration of a legal entity. Only national and independent foreign enterprises may make such deductions (see chapter IV).

- (d) Contribute to the production of goods which help to increase exports, and
- (e) Make possible large-scale reductions in manufacturing costs.

These criteria do not appear to be completely satisfactory in themselves, nor does the establishment of general criteria like those suggested seem to constitute a particularly viable proposition. In fact, it is difficult for any one of these criteria to be adopted into objective and accurate operational practices whose implementation will not give rise to controversy. It is difficult, for example, to give concrete form to the comparison between demand and supply on which the first criterion is based. Not only must considerations of prices, market situations and the period of time within which the comparison of supply and demand is made be taken into account, but a new dimension must also be introduced into estimates of demand so as to take external markets into account. Nor is it easy to define "raw materials or industrial components which are plentiful in the domestic market". This "plentiful" situation has no real meaning: it may exist in fact or be merely a potential situation. The development of this potential could be an equally valid aim - and hence an assessment criterion for fixing deduction coefficients. To sum up, each of the criteria proposed, with the exception of the last (which refers to large-scale reductions in production costs), seems rather to form part of an industrial development strategy based on import substitution than part of the strategy actually in force, which is based on openness to external markets and the restoration to the entrepreneur of much of the breadth of decision which previous excessively rigid economic policies had taken from him.

Lastly, the actual idea of fixing criteria in order to establish a relatively rigid scale of priorities calls for some comment. A proposal of this type could be valid if the government had already formulated an industrial development strategy sufficiently explicit and detailed to permit criteria like those suggested to be drawn from it, provided they were sectoral criteria and not overall criteria covering all manufacturing activities. In view of the absence to date of such an explicit and detailed strategy, however, the establishment of general criteria would probably put obstacles in the way of the flexible and efficacious administration of imports of technology, by creating illusions of automaticity and thus giving rise to new sources of friction between the enterprise and government agencies.

It might be useful to introduce an element of differentiation in the tax deductions and, by extension, in the permitted remittances, but it would be necessary to keep very much more in mind the type of technical know-how anticipated and the forms and duration of its transfer, rather than criteria of a general nature like those mentioned above. It would perhaps be much more difficult in

/practice, however,

practice, however, to establish compatibility between degrees of priority (i.e., the permitted coefficients of deductions and remittances) deriving from the respective application of the first and second types of criterion, and efforts to procure such compatibility could result in the loss of the limited margin of rationality introduced (probably after solving sizeable practical obstacles) through one or other of these means. It may be asked, for example, what treatment should be given to a contract which is of high priority from the point of view of the economic criteria suggested by the IPEA and referred to above, but which provides for forms and periods of transfer which are unsuitable. In such a case, which of the two groups of criteria should predominate?

As regards the differentiation of the permitted deductions and remittances according to the type of technology transferred, the IPEA study distinguishes between contracts establishing longer-term links between the contracting parties, such as more or less permanent technical assistance contracts and contracts for the use of trademarks and patents for products or manufacturing processes, on the one hand, and contracts which establish more temporary links between the enterprises on the other (i.e., those in connexion with the execution of studies and projects, or collaboration to solve specific technical problems).

In the first case, which is the more important in practice and which, as we have seen in chapter V, involves greater volumes of payment, stricter rules are required than in the second case, where more flexible treatment could be advocated, in accordance with the particular features of each case.

To sum up, according to the proposed system, the maximum percentages deductible for permanent technical assistance and licenses for the use of patents and trademarks should be established. To this effect, a decree replacing Decree No. 436 would define maximum percentages for each category of transfer and each type of economic activity. In decreasing order, these categories would be: permanent technical assistance, granting of the right to use a patent, and granting of the right to use a trademark 20/.

20/ Ibid., p. 83. The continual references in the study under discussion to the percentages which may be deducted, and the absence of explicit references to the maximum percentages permissible for remittances abroad, perhaps stem from the already noted fact that, in current practice, the Central Bank uses the limits of the deductions laid down in the law on income tax to fix the permissible limits for remittances. This parallel between deductions and remittances cannot be invoked, however, in the case of branches and other non-independent foreign enterprises, because, as already stated, the remittances are not considered as costs, and therefore cannot be deducted.

This proposal of the IPEA study gives an idea of how the problem of compatibility, referred to some lines back, should be treated. The economic assessment criteria could be used to set limits or maximum coefficients for specific categories of industrial activity. The other criteria, relating to the type of technology transferred, etc., would be complementary to the first, and would aid the ordering of each contract on a descending scale starting from the maximum deduction permitted. This procedure would, of course, mean giving preference to a classification by economic criteria instead of one based on the type of technology transferred, the transfer terms, the duration of payments anticipated, etc. Such a solution is logically correct, but economically clumsy, and adds weight to the arguments already mentioned against the suitability and desirability of these criteria.

Continuing with the enumeration of the suggestions made in the IPEA study for the reform of the tax system on the transfer of technology, another suggestion is that the maximum deduction for income tax purposes, provided for in the previous scale should be revised on the basis of a review of each contract to assess the quality of the technology transferred, and a new scale should be introduced, based on the contribution of each contract to the increase of the technical know-how and inventive capacity of the skilled labour of the country. It is also recommended that "product engineering" should be remunerated in inverse ratio to the magnitude of the anticipated production series; this would be a way of avoiding a very unbalanced treatment which would benefit products for mass-consumption or the production of standard models, while being detrimental to products manufactured according to individual requests (basic equipment) or short production series (machine-tools for specialized use, for example).

As regards the duration of the payments anticipated in the contracts, it is proposed that the five-year limit should be maintained for those going under the title of permanent technical assistance contracts, with the possibility of an extension for a similar length of time, when proved necessary, through a gradual reduction of the deduction permitted for the first five years (100 per cent in the sixth year; 80 per cent in the seventh; 60 per cent in the eighth; 40 per cent in the ninth and 20 per cent in the tenth).

As regards grants of rights to use patents and trademarks, the period of validity of the subject of the concession should, of course, be kept in mind.

In the case of contracts establishing shorter-term links between the contracting parties - complete investment projects, assistance in solving specific problems, assistance in the specification or purchase of equipment, assembly of equipment - special treatment for each case is proposed.

/Another proposal

Another proposal is to modify the percentage of income tax applicable at the time of the remittance abroad, which is at present at the fixed rate of 25 per cent. This would be reduced to 15 per cent in cases of permanent technical assistance, temporary technical assistance and complete investment projects, with a view to promoting such transfers of technology. In the remaining cases - royalties for the use of patents and trademarks - the present rate of 25 per cent would continue to be applied.

According to the IPEA study, consideration should also be given to a complementary tax, along the same lines as that applied to remittances of profits and dividends, which would be applied to all forms of transfers of technology exceeding the percentage permitted by Decree No. 436 and authorized by the Central Bank (payments exceeding the limits fixed would be subject to a complementary tax equal to the percentage excess over the sum permitted) 21/.

Lastly, it is proposed that, independently of what is laid down in the contracts regarding the responsibility for the payment of income tax on the remittances in respect of the use of imported technology by the Brazilian or foreign enterprise which has obtained the user's rights, this tax should be calculated for the purpose of planning within the limits approved for remittances.

The following is a summary of the comments on the foregoing recommendations:

(a) The promotional effect of the reduction of income tax would not perhaps be very great, or at least not so great as to compensate for the disadvantages of the discrimination which would emerge against other forms of transfer of technology, and it would perhaps mean the accentuation of a disadvantage which exists at present and which the IPEA study criticizes in another context: the tendency to present a contract under the title of simple technical assistance, when in fact it involves the use of patents or trademarks.

(b) It is not easy to place in a single category, as being of less priority (and subject to a higher income tax), all the cases where the use of patented processes or the manufacture of products protected by patents or trademarks are concerned, for the granting of rights in connexion with patented processes and

21/ Ibid. It is understood that it would be applied to the oldest contracts still in force, which provide for percentages in excess of those indicated in the decree, and to exceptional cases authorized by the Central Bank.

products does not automatically imply a category of transfer which is of less interest for the country, while the case of trademarks which may include a considerable element of technological innovation should not be ignored either. Moreover, the mere use of a trademark, with or without the element of technological innovation, may in some cases lead to an expansion of exports which is a high-priority national aim.

(c) As regards the introduction of a tax on excess remittances in payment for technology, similar to the supplementary tax on remittances of profits in excess of 12 per cent on the registered capital and reinvestments, it should be borne in mind that under present conditions such a modification would have no great practical significance, for as was pointed out earlier, the excess remittances in payment for technology over the percentages laid down in Decree No. 436, which the Central Bank has used to govern the acceptance of contracts for registration, only applies in the case of the oldest contracts, which are gradually reaching their term of expiry, or in exceptional cases of this type approved by the Central Bank. In practice, the proposed tax change would only affect cases which will be becoming ever fewer in the future, so it would be rather pointless.

(d) Lastly, as regards the duration of payments, the introduction of a decreasing scale of percentages in relation to the rate initially approved, where technical assistance contracts are extended for an additional period of five years, does not seem to be a solution to the problems observed, which are the impossibility of judging the need for and effectiveness of the technical assistance provided and graduating the duration of payments authorized in terms of the degree of priority attributed to the industrial sector and the type of technical know-how transferred. The solution should be sought in a much more elastic and detailed system, which could be implemented through the establishment of the necessary institutional mechanisms.

4. Problems related to restrictive clauses in contracts

The restrictive clauses most frequently found in the contracts analysed here are of three main types:

(a) those prohibiting the export of products manufactured with foreign technology obtained under the contract, either in general or to certain specific external markets;

(b) those permanently or temporarily prohibiting a Brazilian enterprise which is granted the right to use a patent or receives technical assistance from using the imported technical know-how once the contract has expired;

/(c) those

(c) those providing for the cession to the foreign enterprise concerned of all rights in respect of any improvements introduced by the firm which is granted the patent for the relevant process or product.

To these three restrictions may be added a fourth, i.e., that encountered in the many agreements giving the beneficiary firms the exclusive right to use the foreign technical know-how or patent covered by the agreement within a specifically designated territory.

The Central Bank at present has a well-defined attitude to the first type of restriction, usually rejecting the registration of contracts which include clauses of this kind. Contracts which include restrictions on future exports by the Brazilian party are registered only in exceptional cases on instructions from the competent director, which must be ratified by the Board of Directors of the Bank 22/.

IPEA suggests that the Central Bank should retain its power to authorize the registration of such contracts in special cases after consultation with the Industrial Development Committee of the Ministry of Industry and Trade. It cites the example of agreements for the manufacture of products where no similar local product exists and only technical know-how owned exclusively by the foreign contracting party is involved. The possibility of some exceptional cases of a different nature is admitted, but it is felt that there is no justification for cases of this kind, which are too reminiscent of import substitution policy aimed only at the domestic market. The exceptional cases should be justified by circumstances such as the duration of the restrictions, the particular geographical area of the proposed restrictions in the light of the possible export potential, the nature of the process or product, the degree of innovation displayed, and the practical possibilities of reaching agreement in a negotiation on different bases from those proposed.

The IPEA study recommends that the other two types of restrictive clauses should be rejected by the Central Bank on the grounds that they constitute an abuse of economic power and prevent the proper integration of imported technology 23/.

In these cases, too, it seems difficult to establish a generally applicable rule. On the one hand, the appropriation by the foreign enterprise of the rights in respect of any improvement or innovation introduced by the firm which is granted the patent is

22/ Ibid.

23/ Ibid.

a customary procedure in certain branches of industry - chemical or "process" industries in general - which is not confined to contracts between enterprises in developed and developing countries: on the contrary, it is a frequent feature of contracts between enterprises (and countries) with the same bargaining power. Furthermore, this apparently restrictive clause has a compensating effect: the fact that by virtue of this clause the enterprise which is granted the patent has free access, throughout the period covered by the contract, to all the changes and improvements introduced in the process or in the product by other enterprises holding the same patent 24/.

Besides the problems connected with restrictive clauses in the contract, the exclusive character of the agreement is also an important problem. As a rule, suppliers of technology in developed countries prefer a contract to be exclusive rather than non-exclusive, and so does the firm which has obtained the patent rights, since it is able to gain higher profits by virtue of the monopolistic power such a contract provides. Nevertheless, from the standpoint of the dissemination of technology, agreements involving exclusive technical collaboration are not favourable to the developing countries. In particular, the licensed know-how which is most commonly used or licensed patents which have a wide coverage should be introduced under a non-exclusive contract. Naturally, if the contract contains special clauses which provide that the firm granted the patent through a contract with the firm granting it, or the latter firm itself, can grant a sub-licence to other enterprises, the disadvantages referred to is somewhat reduced. In conclusion, although a non-exclusive agreement is more favourable, if an exclusive contract is inevitable because of the supplier's uncompromising attitude, the restrictive clause relating to sub-contracts should not be accepted. It may be noted that it would appear to be impossible to determine whether or not such clauses should be allowed in a contract without considering other conditions which should be included in the same contract, e.g., those connected with the cost of the technology specified therein. It is true that these considerations imply the need for full information and considerable bargaining powers on the part of the enterprise acquiring foreign technical know-how, but the lack of these requisites can hardly be remedied by imposing restrictive regulations as strict as those proposed. The firm's inadequate external bargaining power could, however, be bolstered by some suggested institutional changes which are considered later in this study.

24/ See section 2 of chapter III for information on customary types of contracts in the chemical industry.

5. Institutional aspects of the process of transferring technology

The previous sections in this chapter have presented and commented upon the suggestions contained in the IPDA study with respect to the measures which could be adopted within the existing institutional structure. The same study, however, also recommends that this institutional structure be changed and that a new specialized body be established within the framework of a national science and technology policy, to assume functions currently performed by the Central Bank in connexion with the analysis, negotiation and registration of contracts, while in addition instruments should be created through this body to perform other functions which are described above as indispensable for making the transfer process more systematic but are partially or completely neglected under the present inadequate institutional structure.

The proposed body would be responsible for implementing the policy governing the transfer of technology, absorbing many of the tasks currently performed by the Central Bank with respect to the evaluation and control of the fulfilment of contracts and providing Brazilian enterprises requiring foreign technology with direct advisory assistance in the phases of selection and negotiation of the technical know-how to be transferred. Thus, it would judge whether or not the know-how should be imported, choose the technology best suited to the country's development requirements, and strengthen the bargaining power of Brazilian enterprises in the world technology market.

This technological body would have a highly qualified technical staff and a permanent file of information capable of indicating, for example, the real demand for technology, the characteristics of the world technology market, available technological options and their social cost, and foreseeable technological developments 25/.

It would thus orient the absorption of foreign technology through the following activities:

- Analysing the world technology market in the sense of evaluating the supply characteristics, ascertaining the existence of other sources and determining the comparative costs of the various technologies;

- Centralizing the data on transactions involving the transfer of technology;

25/ Ibid.

- Examining contracts for the transfer of technology whose registration is requested, in order to assess:

- (i) whether the imported technology is really required;
- (ii) whether the imported technology is compatible with national economic and social conditions and requirements;
- (iii) whether the payment envisaged is in line with prevailing world market conditions and the importance to Brazil of the technology it is proposed to transfer;

- Participating in technology transfer negotiations between Brazilian and foreign enterprises;

- Examining every contract relating to a transfer to determine whether or not the tax deductions under the existing legislation are applicable; and

- Deciding the income tax deduction limits, under existing legislation, applicable for the determination of the maximum remittances allowed for the transfer of technology, according to the nature of the contract and the production activity for which the technology is intended.

Furthermore, according to the suggestions put forward in the IPEA study, the technological body should maintain close relations with other components of the scientific and technological complex in Brazil, with the entire production activities sector, and with public and private agencies concerned with disseminating information and technical know-how to the whole of Brazil's production system. These functions would be performed by productivity centres and an information centre, as well as by the technological body itself.

A flow of requests and replies would be established between the various bodies, thus linking them to one another, to the production system and to other countries. Study of these flows would enable an integral view to be gained of the transfer of technical know-how and the operation of the technological body within the context of the more general process of the creation, transmission and use of technology in Brazil.

The IPEA study includes a matrix table, reproduced later in this study, illustrating the key position which the proposed technological body would occupy.

This attempt to establish links between institutions concerned with the development of science and technology and the transfer of foreign know-how suggests the following main comments:

(a) On the one hand the proposed system is too ambitious as regards the scope of the functions assigned to some bodies, especially

/the technological

the technological body, while on the other hand it neglects some factors which are of fundamental importance for the application of the transfer process, such as those related to the formulation and implementation of industrial policy;

(b) Overall policies, which indirectly have a considerable impact on the transfer of technology (for example, those connected with control of foreign trade), should also have a place in the proposed system of interrelationship, through some co-ordinating mechanism linked to the other elements of the government structure, particularly the Ministry of Planning;

(c) Lastly, some other "sub-systems" of the transfer process, such as industrial property, should be explicitly included in the general system proposed.

The following chapter deals further with some of these subjects, particularly the relations between the policy governing the transfer of technology from abroad and industrial policy.

TO FROM	PRODUCTION SYSTEM	SEGMENT OF SCIENCE AND TECHNOLOGY COMPLEX				OTHER COUNTRIES
		PRODUCTIVITY CENTRES	INFORMATION CENTRES	TECHNOLOGICAL BODY	RESEARCH SECTOR	
PRODUCTION SYSTEM		-Enquires on modernization and reorganization projects	-Specific enquires	-Demand for technology	-Demand for technology (specific research)	-Demand for technology (according to evaluation by technological body)
SEGMENT OF SCIENCE AND TECHNOLOGICAL COMPLEX	PRODUCTIVITY CENTRES	-Technical extension programmes and determination of technological requirements for the attainment of higher levels of efficiency	-Specific enquiries	-Information on technological models of the production system -Specific enquiries	-Information on technological requirements for the modernization and reorganization of the production system -Specific research	-Specific research (according to evaluation by the technological institution)
	INFORMATION CENTRE	-Distribution of scientific and technical documents -Dissemination of information about internal supply of technology and research potential -Reply to specific enquiries	-Distribution of scientific and technical documents -Dissemination of information about internal supply of technology and research potential -Reply to specific enquiries	-Distribution of scientific and technical documents -Dissemination of information about internal supply of technology and research potential -Dissemination of information about external supply of technology	-Distribution of scientific and technical documents -Dissemination of information about internal supply of technology and research potential	-Enquiries on supply of technology or specific research -Enquiries on specific scientific and technical documents
	TECHNOLOGICAL BODY	-Evaluation of other possible sources of technology (internal or external) -Advisory assistance in the negotiation of contracts for the transfer of technology -Verification of use of imported technology -Control of payments (through the Central Bank)	-Reply to specific enquiries	-Enquiries on internal or external supply of technology or specific research -Enquiries on specific scientific and technical documents	-Guidelines for development of technological models different from those found abroad -Demand for technologies for the production system, originally directed to other countries	-Negotiation of contracts for the transfer of technology -Verification of supply of imported technology -Control of payments (through the Central Bank)
	RESEARCH SECTOR	-Internal supply of technology	-Specific research	-Information on supply of technology and internal research potential	-Information on supply of technology and research potential (mainly through Information Centre)	-Specific research
OTHER COUNTRIES	-Supply of technology (through the technological body)	-Study of individual modernization and reorganization processes	-Information on supply of technology -Scientific and technical documents	-Supply of technology (according to demand from production system)	-Specific research	



Chapter VII

TRANSFER OF TECHNOLOGY AND INDUSTRIAL POLICY IN A CONSUMER INDUSTRY

1. General situation of the industry

The Brazilian textile industry is in a state of relative stagnation and in recent years has suffered repeated crises which have led to the closure of many plants and a reduction in working time in some establishments 1/. The chronic stagnation of this sector, over and above the periodic crises that aggravate the adverse effects of its lack of growth, is reflected in the per capita consumption of fibre, which has remained virtually at the same level and is far below that registered in other parts of the world, even allowing for the average income and the possible effect of differences in climate 2/.

Nevertheless, the synthetic fibre branch of the industry is developing at an accelerated pace and, although its growth is difficult to calculate in quantitative terms, it is known that new plants are constantly being installed and new trademarks for synthetic fibres are continually appearing on the market. This progress is evidently taking place at the expense of natural fibres and thus further aggravating their situation. The reasons for the growing interest in synthetic fibres in Brazil and in developing countries in general, many of which also produce natural fibres, are still not too clear and are the subject of continuing controversy among economists and textile specialists.

1/ The latest crisis was at the end of 1968 and lasted most of the first half of 1969. See the report of the Working Group for the Study of Problems of the Textile Industry which was set up by the Department of Finance of the State of São Paulo on 28 April 1969.

2/ ECLA estimates Brazil's per capita consumption at 4.84 kilogrammes in 1965 and a little over 5 kilogrammes in 1972, in accordance with an income-elasticity coefficient of 0.65. Since the coefficient is so low, the recent spurt in the growth rate of the gross national product is unlikely to alter this figure very much. A more favourable situation within the national context is found in the Northeast region, where the per capita consumption of textile fibres rose appreciably in the 1960's, owing to the faster growth of the gross regional product and to the higher income-elasticity coefficient in that part of the country. In fact, per capita consumption of textile fibres in the Northeast, which was 42 per cent of the national average in 1965, is expected to be about 70 per cent of the figure for the whole country by 1980 (see SUDENE, Pesquisa sobre a Indústria textil do Nordeste, Recife, 1971).

/If the

If the advantages offered by the physical properties of these fibres are considered against their high price, it seems reasonable to think that their consumption at the expense of natural fibres does not bring any real advantage to the economy as a whole or to the consumer 3/. However, whether or not this is a case of maladjustment between the technology imported from the major industrialized centres and the requirements and characteristics of the developing countries, the introduction of synthetic fibres is a reality and the expansion of their consumption seems to be an irreversible fact 4/. It can but be hoped that an intelligent economic policy will use the challenge represented by the introduction and continued expansion of the use of these fibres as a spur to the natural fibre industry to modernize its equipment and technology, thus improving its chances of retaining its share in the consumption of textile products.

Such a policy should provide not only for the reorganization and financing of new equipment (and the actual effort of reorganization), but also for a basic structure of research, experimentation and absorption of new techniques, in connexion not only with equipment but also with the more economic utilization of Brazil's natural fibres, either separately or in combination with synthetic fibres.

When the extensive study on Brazil was completed in 1962, ECLA suggested that a start be made on re-equipping the textile industry and modernizing its administration and technology 5/. Through a sound programme of restructuring the industry it was hoped to create favourable conditions for expanding the domestic market and participating in the international market. The political instability during the period 1962-1964 prevented the detailed proposals that were formulated from being put into practice, however, while from 1964 until a short time

3/ This subject is discussed in detail in ECLA, "La industria textil en América Latina", vol. XII, "Informe regional" (E/CN.12/796), 1968.

4/ Nevertheless, it should be noted that the recommendation contained in the recent SUDENE report on the restructuring of the textile industry in the region reflects persistent doubts regarding the desirability of this situation. One recommendation is that the incentives to the production of sacks of polypropylene and other synthetic fibres be temporarily suspended until their usefulness and superior technical and economic qualities over those made with natural fibres have been proved (SUDENE, op. cit.).

5/ SUDENE had already examined the situation of the textile industry in the Northeast area a few years before, and on that basis had prepared a regional programme of reorganization and modernization.

ago the main obstacle was the fear that employment in the textile industry would fall too drastically if the sector were reorganized and modernized under conditions where, owing to the measures taken to stabilize the currency, it was not easy to absorb the displaced manpower by expanding other sectors of industry. Recently, however, with the progress made in monetary stabilization, hand in hand with high employment levels and an accelerated rate of overall industrial growth, the time has come to consider once again the large-scale reorganization and modernization of the textile industry 6/.

The importance of the textile sector in Brazil's manufacturing industry has been shrinking steadily, the share of the gross value of its production falling from 15 to approximately 10 per cent of the total between 1950 and 1965. This trend reflects a change in the sectoral composition of the economy which was only to be expected, and which derives from the rapid industrialization process over this period. The percentage figure for 1965, however, which is almost certainly not too different from that recorded in subsequent years, shows how important the manufacture of textiles still is in Brazil's industrial output. Moreover, the present general trend of official economic policy, which is to promote a vigorous increase in exports of manufactures through flexible exchange rates and fiscal incentives has opened up new export prospects for the textile sector which may not only play a direct part in improving the balance of payments position, but also make it possible to increase the scales of production on a selective basis 7/, thus extending the range of technical and

6/ SUDENE has just completed a new diagnosis of the textile situation in the Northeast, as a basis for a new phase in the work of reorganization and modernization initiated in 1960. Moreover, the Ministry of Industry and Trade is at present carrying out similar research in other parts of the country, with the object of formulating a programme for the reorganization, modernization and development of the textile sector.

7/ Access to world markets, particularly Western Europe and the United States, would seem to be an almost indispensable factor for carrying out reorganization and re-equipment programmes, since it encourages new investment without which the administrative and technological reorganization of enterprises would be much more difficult.

economic possibilities and widening the choice of options open to enterprises engaged in advanced programmes of reorganization and modernization 8/.

The degree of obsolescence of Brazil's inventory of textile machinery is very high: a situation which is repeated to a lesser extent in almost all the Latin American countries except Colombia and Venezuela.

ECLA's studies show that only 24 per cent of the spindles and 23 per cent of the looms used in the cotton industry, which is the most important part of Brazil's textile industry, can be classified as modern 9/. The percentages for the Latin American countries as

8/ Without going into too much detail, suffice it to say that Brazil recently obtained a considerable quota for exports of textiles to the United States; more important still, this establishes a new principle which holds out enormous possibilities over the medium and long term, since as the United States textile industry gradually becomes less competitive because of the trend of internal costs of the factors of production, more export opportunities will arise owing simply to the natural growth of the consumer market in that country. This possibility, which is now beginning to materialize, was specifically envisaged in a study ("Selection of techniques and manpower absorption") prepared by ECLA in October 1962 and presented with minor changes at the United Nations Seminar on Industrial Programming in March 1963. A tentative projection based on the probable future trend of the cost of factors of production is to be found in chapter VI of this study.

9/ In line with the criteria set forth in detail in ECLA's studies on the textile industry, which combine the age of the equipment (10 years or less in this category) with certain minimum levels of performance. These data are a few years old, but certain partial information suggests that the situation continued virtually unchanged until a fairly recent date. The reactivation of Brazil's economic growth, the launching of government financing programmes under highly favourable conditions, the merging, concentration and large-scale reorganization of enterprises in the traditional branches of industry and the successful policy of incentives for exports of manufactures have gradually brought about changes. In addition, the programme for restructuring the textile industry in the Northeast, which was initiated by SUDENE in 1960 but had very poor results in the first few years, put on a decided spurt in the last five years. Thus, the significant modernization of technology in that area resulted in a reduction in the average age of the equipment. In 1959, 54 per cent of the spindles and 81 per cent of the looms used in the cotton industry had been operating for over 30 years. In 1969 these indexes had dropped to 19 and 32 per cent, respectively (SUDENE, op. cit.).

/a whole

a whole are 44 and 46 per cent, respectively. A study of the conditions of operation of the machinery park shows far from rational utilization, not only because of the low production levels per unit of equipment owing to internal operational deficiencies, partly aggravated by the age of the equipment, but also as a result of the under-utilization of the machinery and the difference in the degree of utilization between the various sub-sectors of the industry.

2. Technological options

The need to reorganize this manufacturing activity leads naturally to the idea of modernizing the technology through the introduction of equipment, production processes and methods of technical and administrative organization which are being developed in the industrialized countries. As a result of the more accelerated technological development over the past two decades, the textile industry, which has traditionally been characterized by the low capital-intensity of its production facilities and the low level of wages paid, has rapidly altered these characteristics and is being converted into an industry whose capital-intensiveness ranks relatively high among the various sectors of Brazilian industry. The speed of this technological development and the very nature of the techniques and processes adopted open the way to - and give rise to the problem of - choosing between the different technological options of investment and production which are currently open 10/.

Since labour is plentiful and capital scarce in Brazil, it seems plausible that highly capital-intensive techniques may not be the most suitable for the modernization programme; in other words, the techniques which it would be desirable to adopt from the point of view of Brazil's economic policy would not necessarily be the most suitable techniques from the standpoint of the profitability of private firms.

10/ The textile industry and a major part of the engineering industries constitute the industrial sectors where the technological options are especially significant, not as a succession of historical stages of development translated into increasingly efficient production functions, but as technical variants corresponding approximately to the same technological stage, i.e., representing points near the curve representing the present most efficient production function. This stems essentially from the discontinuous character of the production processes, the existence of equipment with different automation characteristics for the execution of the same operations, and the possibility of various combinations of different equipment. Accordingly, there seem to be wide possibilities of substitution between capital and labour in these industries, compared with other sectors.

In a detailed study on the subject, based on technical and economic data on preliminary projects, ECLA attempted to evaluate the various economic options available in line with different hypotheses regarding the cost of factors of production 11/. It was pointed out in this study that, for a more systematic analysis, the production techniques most generally used in the cotton textile industry could be grouped in five categories roughly corresponding to the years 1930, 1950, 1960 and 1965 on the basis of the most modern machinery available in those years, plus an additional option relating to equipment still at an experimental stage (semi-continuous spinning process combined with the production of fabrics on shuttleless looms) 12/.

Of the five levels of technology, only three were considered feasible under the conditions prevailing in Brazil and Latin America in general. The 1930 level was discarded because there are no longer any machines with those characteristics in the market, and the experimental level because of the difficulty of obtaining enough information about the cost of such equipment.

The remaining levels (A, B and C, in rising order of complexity) show investment/labour ratios which amply confirm that the textile industry has ceased to be a highly labour-intensive sector. The ratio of 6,700 dollars per worker in 1950 had doubled by 1960 to 12,700 dollars, and no less than trebled by 1965, to over 20,000 dollars per worker 13/.

The table below gives the coefficients of investment, unit cost and labour utilization according to the different technological levels, considered in relative terms (unless otherwise stated), on the basis of absolute values in dollars at 1965 prices.

11/ See ECLA, "The choice of technologies in the Latin American textile industry" (E/CN.12/746), February 1966. Although they relate to the cotton textile industry, the conclusions in this study are roughly applicable to the manufacture of other fibres (wool, jute, sisal, flax, and synthetic and artificial fibres), in view of the considerable technological similarity between these industries.

12/ This chronological correspondence does not conflict with what is affirmed in footnote 10, in keeping with which the options should run concurrently and relate approximately to the same production function rather than to successive production functions. In actual fact, the chronological correspondence was adopted in the ECLA study for purposes of presentation. The technological options finally retained relate to equipment which is available simultaneously.

13/ Only about 10 per cent of these values represents financial investment: the remaining 90 per cent reflects the magnitude of the fixed investment.

/Technological options

<u>Coefficients</u>	<u>Technological options</u>		
	<u>A</u>	<u>B</u>	<u>C</u>
Total cost per unit of product	100	92	89
Cost of labour per unit of product	100	59	44
Cost of capital (depreciation and returns) per unit of product	100	108	114
Investment per unit of product	100	109	115
Product/capital ratio	100	92	87
Investment per worker	100	190	310
Investment per worker in absolute values (dollars)	6 700	12 700	20 600
Labour employed per unit of product	100	57	37
Value added per worker	100	145	211
Surplus available for reinvestment	100	119	126
Total investment required (for installation of plant of minimum economic size)	100	127	146

Source: "The choice of technologies in the Latin American textile industry", op. cit.

The above data may be analysed from two opposite points of view: that of minimizing cost in relation to the enterprise's own profitability, or that of maximizing the product/capital ratio, combined with a strategy of optimum utilization of the scarce capital existing in the economy. Each of these points of view leads to a different conclusion as to which would be the most advantageous technological option, and as it turns out, neither of these criteria is suitable if it is applied independently of other economic policy considerations, particularly employment and the reinvestment capacity associated with the different technological options for the renovation of equipment.

If the aim is to minimize the total cost per unit of fabric produced, the best option would be that of re-equipping with the technologically most advanced machines. If the criterion based on the capital/product ratio were adopted, however, the situation would be precisely the opposite, since technological progress at the successive levels would gradually undermine the economic utilization of capital.

/If the

If the data in the foregoing table are analyzed from the cost standpoint, they would seem to indicate that the advantages of an appreciable reduction in costs through the modernization of technology to a very advanced level are not so conclusive as might appear at first sight. The results show that at this level the total cost per metre of fabric produced is minimized, but the cost is only 11 per cent lower than the cost recorded at the least advanced technological level. Passage from level A to level B shows the sharper reduction in the unit cost, i.e., 8 per cent out of the total of 11 per cent. In other words, the saving in costs between the intermediate and the most advanced levels is minimal, compared with the much more significant saving between the least advanced and the intermediate level. It is further observed that labour costs are reduced by 41 per cent at level B and 56 per cent at level C (in relation to A), while the cost of capital (depreciation plus returns on investment) shows increases of approximately 8 and 14 per cent, respectively.

In relation to the immediately preceding technological option, level B offers the biggest reduction in costs (although not very considerable in relative terms), while at the same time it involves the lowest rate of increase in the cost of capital and reduces to more acceptable proportions the displacement of manpower resulting from the greater automation of the equipment.

If the product/capital ratio approach were adopted, the most suitable technological option would be that characterized by the lowest capital-intensity and the most intensive use of labour ^{14/}. On the other hand, if the opposite approach were adopted, labour would be displaced on a very large scale. For such an option to be feasible, therefore, the reductions in manpower as a result of the modernization of technology would have to be kept within the limits of the possibilities of absorbing the displaced manpower in other expanding sectors of industry. In view of Brazil's vigorous industrial growth, less importance attaches at present to the creation of employment - a fact which favours the technologically most advanced form of modernization. Account should also be taken of other factors pointing in the same direction, especially the smaller reinvestment capacity existing at the less capital-intensive level.

In practice, a higher product/capital ratio does not ensure the industry's faster growth. On the contrary, since the value added increases in proportion to the greater participation of labour, the

^{14/} What is considered here is an investment policy linked, in particular, to the renovation of equipment in existing industries, since the new large-scale industries capable of rapidly achieving high labour productivity constitute a somewhat different problem which will be considered later.

additional product thus generated will accrue to the workers and most of it will be spent on consumption. The surplus available for reinvestment (depreciation and returns on capital) will thus be smaller at level A than at the other levels, which might slow down the growth of the industry's product and jeopardize the possibilities of a continuing process of modernization and expansion. Furthermore, costs are higher at this level, which is more labour-intensive, and this could endanger the industry's export possibilities. Thus, the best solution would seem to be a technological approach somewhere between the two extremes considered.

It seems clear, therefore, that the technological options in the textile industry, which is taken here as an example of the traditional industries with quite considerable needs in terms of the replacement of obsolete equipment, have appreciable economic and social repercussions, so that everything points to the need for moderation in selecting the techniques to be introduced 15/.

15/ A recent evaluation by SUDENE of the programme for the renovation of equipment and modernization introduced in the Northeast as from 1960 showed that much less manpower was displaced than had been expected. The report states that, during the period 1959-1969, 6,698 workers were displaced by the modernization of plants, to which must be added another 2,636 workers rendered redundant by the closing down of some establishments, making a total of 9,334 workers. Since 7,371 workers were engaged during the same period, however, the balance was only about 2,000. This figure represents less than 7 per cent of the 30,610 workers employed by the cotton textile industry in the Northeast in 1969: a favourable situation which is accounted for by the installation of new plants and the considerable expansion of the production capacity of enterprises which modernized their equipment. Furthermore, the analysis of short-term prospects of employment in the textile industry based on the installation and modernization projects which are being carried out indicate that the expansion of the regional inventory is creating employment at levels that are compatible with social development needs (SUDENE, op. cit.). This is due to the adoption of intermediate criteria for the renovation of obsolete equipment, i.e., along the lines suggested in the text. This feature chiefly reflects two basic principles of SUDENE's textile programme: first, the obligation to modernize by introducing changes in the equipment wherever possible, confining the complete replacement of equipment to cases where modification is impossible for technical reasons or machines with over 30 years' use; and second, the use of equipment manufactured in Brazil, except where it cannot be supplied by local industry (ibid.).

/Consideration should

Consideration should also be given here to the equipping or renovation of the equipment of industries which have reached or are expected to reach when fully established, higher levels of efficiency than the average for the industry. For these industries, which use much more highly skilled and therefore more expensive manpower, the most economical techniques are naturally the most advanced and capital-intensive techniques compared with the rest of the textile industry.

In time, these industries which utilize labour more efficiently will acquire more importance in relation to the whole textile industry, while at the same time, if the rapid rate of development continues and the present export promotion policy is maintained, the Brazilian economy will gradually undergo a change in the relative price of the factors of production: the unit cost of labour will rise in relation to the unit cost of capital.

An attempt is made to express this trend in the following table, where the effects of variations in the relative prices of labour and capital on the unit cost of production are analysed in accordance with the different technological levels.

<u>Labour cost</u> (hypothetical increase over 1965 level)	<u>Capital cost</u> (hypothetical annual rate of interest)	<u>Cost of production per metre</u> <u>of fabric according to</u> <u>technological levels</u> (relative figures)		
		<u>A</u>	<u>B</u>	<u>C</u>
1965 level	16 %	100	93	91
30 per cent higher	12 %	100	89	86
70 per cent higher	8 %	100	86	81
120 per cent higher	4 %	100	82	75

Source: "The choice of technologies in the Latin American textile industry", op. cit.

Plants starting at a more advanced technological level ^{16/} use more highly skilled manpower, pay better and are in a position to obtain financial resources from the capital market on more favourable terms.

^{16/} It should be recalled here that the average level for the textile industry in Brazil conceals sharp disparities, as has been pointed out in various studies on the sector.

/Accordingly, the

Accordingly, the advantages of higher level of technology as regards equipment (i.e., the gradual and constant renovation of equipment in existing plants or the launching of new manufacturing units) are greater for those units which are more favourably placed, and will slowly increase for the whole textile industry. Both these facts must be taken into account in the reorganization and modernization programmes which are described more fully later in this study.

Before concluding this section, it is imperative to stress the need for an institutional structure which can carry out studies such as those described above on a continuing basis, so as gradually to adapt the economic policy instruments chosen to promote the modernization of the textile industry, and also advise the industry itself, particularly the small- and medium-scale enterprises, in the choice of the most suitable production techniques. This need is all the more pressing since most of these techniques are of external origin.

Lastly, the continuing analysis of technological options cannot be dissociated from a rational programme of research both on the manufacture and use of equipment and on the more economic use of fibres available in Brazil and their combination with chemical fibres. Indeed, technical and economic advisory assistance to public bodies and the industry, in close collaboration with the universities, should be an additional function of the institution primarily concerned with technological research 17/. An institution of this kind is indispensable in order to improve the process of the transfer of textile technology from abroad, which will certainly become increasingly important in the next few years, despite the gradual progress that may be made locally in the various aspects of textile technology.

3. Textile policy and programmes for the technological reorganization and modernization of the textile industry

The transformation required in Brazil's textile industry in order to match the ambitious process of industrial development that is taking place, which will involve an average investment of approximately 15,000 dollars per worker 18/ represents a huge technological leap

17/ This was the orientation given to the studies recently sponsored by the Research Foundation (Fundação de Amparo a Pesquisa - FAPESP) of the State of São Paulo.

18/ This is possibly lower than the actual figure, even as an average for the whole industry. The capital intensity required in the medium term by a renovated and modernized textile industry in Brazil, besides depending on general factors related, inter alia, to the overall trend of the Brazilian economy, the balance-of-payments position and the possible policy of protection for the local manufacture of equipment, will be largely determined by the extent to which the local textile industry gains access to world markets, particularly the United States and Western Europe. The accelerated expansion of exports would stimulate the present trend towards increased capital intensity.

/forward. The

forward. The equipment, production techniques and quality control, and the internal organization and financial management required by so large an investment call for more advanced technical know-how than that generally found in the textile industry.

In this respect, attention is drawn to two different but closely interrelated points. First, the limitations of the capacity of enterprises to absorb new knowledge and techniques should be overcome by means of an objective industrial policy designed to create a climate of competition and provide a stimulus for continuing technological progress and constant reinvestment of profits in the modernization and expansion of activities in the textile industry. This policy will have to be formulated and begin to be implemented before any significant results can be expected from the efforts to reorganize and modernize the textile industry in the South/Central region 19/. The second point is that the reorganization programmes, comprising many measures which include different methods of financing combined with promotion and technical assistance (technological, organizational and financial), make up a set of action instruments.

Both these points are closely interrelated but must not be confused. The sector's continuing and clearly-defined industrial policy within the framework of an overall economic and social development policy creates some, but not enough, of the necessary conditions for achieving the proposed objective, i.e., a rapid recovery of the textile industry whose technology is decidedly obsolete. To achieve this objective during the period covered by a ten-year development plan it would be necessary, over and above a textile sector policy, to formulate and implement special programmes of reorganization and renovation of equipment.

Textile policy should lay down the basic guidelines to be followed on aspects closely linked with Brazil's economic and social development strategy. Thus, it should define the textile industry's role in the absorption of manpower, the export of manufactures, the development of particular regions, the introduction of a specific division of labour within the country, the reduction of relative prices of general consumer goods as part of a national policy aimed

19/ This geographical demarcation is explained by the fact that a programme for the Northeast of Brazil is already at an advanced stage of execution, as indicated previously. This re-equipment programme, which was drawn up without the support of an integrated industrial policy for the sector, was feasible because of the modest scale of the textile industry in the Northeast compared with the rest of Brazil: the plants in the SUDENE region account for only about 10 per cent of the gross value added by Brazil's textile industry.

/at redistribution,

at redistribution, etc. 20/. Of the options presented in relation to these basic issues, certain objectives and guidelines will be much more clearly defined and more easily translated into operational decisions regarding, inter alia, the choice of techniques (and capital-intensity) in the establishment of new plants and the reorganization and modernization of existing plants whose efficiency and productivity are below average; the minimum economic size of plants for the production of each type of fibre; specialization or diversification of production; and the concentration in bigger units of certain operations requiring a larger scale of production and more complex technology. The group of provisions adopted in relation to all these points, which should be periodically adjusted to the prevailing conditions, would constitute an industrial policy for the textile sector 21/.

On the other hand, reorganization and modernization programmes include much more specific measures, for implementation within a set time, which are aimed at significantly raising the technological and administrative level of enterprises of certain types or in certain geographical areas within a comparatively short period. To implement such programmes before a sectoral programme has been formulated is justifiable only in special cases, when the enterprises concerned cover a small part of the industry and when serious economic and social problems exist. This is so in the case of the textile industry in the Northeast, and also in the case of weaving mills, particularly

20/ Arguments in favour of sectoral industrial development policies and the analysis of the content of such policies were for many years the main features of ECLA's studies in the field of industry. The many studies prepared along these lines include: Report of the United Nations Seminar on Industrial Programming, 1963; "La programación de industrias tradicionales: elementos de una metodología para la industria textil", 1963, and "Los principales sectores de la industria latinoamericana: problemas y perspectivas", vols. I and II, 1965. See also the recent studies by Zoltan Szabó, "El concepto de la planificación subsectorial", and Albert Waterston, "Sector programming", presented at the meeting of experts on selected industrial and technological development problems in Latin America, sponsored by the Inter-American Development Bank (Washington, June 1971).

21/ The Ministry of Industry and Trade is carrying out a study with a view to making a detailed diagnosis of the present situation of the textile industry in the South/Central region, as a basis for the formulation of the relevant sectoral policy.

/in the

in the Americana region in the State of São Paulo, which consists of the city of that name and neighbouring municipalities 22/.

The vicissitudes of the textile industry in Americana over a period of many years and the recent attempts to study them and find a solution through a specific programme prepared by the Banco de Desenvolvimento do Estado de São Paulo (BADESP) at the end of 1970 and the beginning of 1971 illustrate the nature of the problems and particular situations arising in the implementation of a programme for the modernization and reorganization of the textile industry.

Comprising as it does over 400 cotton and artificial and synthetic fibre weaving mills, most of which are fairly small (averaging about 10 to 15 looms per establishment) and have serious technological and operational shortcomings, the textile industry in Americana is also characterized by the fact that most of the small-scale entrepreneurs are facionistas 23/.

The diagnosis of the textile industry in Americana showed that the anomalies recorded there were due basically to the facionista form of activity and excessive geographical concentration, combined with the very low degree of industrial diversification and the consequent limited choice of employment. In view of the existing framework of overall economic policies aimed at achieving full employment, maintaining the competitive system, strengthening the Brazilian entrepreneur and decentralizing industry in relation to Greater São Paulo, and in view of the dynamic growth of the economy as a whole, it was possible to establish a specific programme of action which included a group of measures designed to achieve common ends. The lack of an industrial policy for the textile sector was not considered a serious obstacle to the formulation of this partial reorganization and modernization

22/ These two regions, which are so different in size, account for a roughly similar proportion of Brazil's textile industry (nearly 10 per cent). This means that there is an abnormally high concentration of the textile industry in Americana, which makes the area excessively vulnerable to the ups and downs of this sector.

23/ Facionistas are manufacturers who undertake work for third parties (merchants or other manufacturers in the same line), receiving from them the raw material and specifications for the work, which is contracted for in advance at a fixed price. Facionistas therefore sell only the work done by their staff (often members of their own families or minors who are paid only a small wage) and use their own machines, generally old mechanical looms operating under unsatisfactory technological conditions. This whole group of characteristics, which cannot be analysed here in detail, leads to a highly unfavourable socio-economic situation.

/programme, because

programme, because of the existence of clearly-defined overall economic policy guidelines at the national and State level, the relatively small size of the sub-sector, and the urgent nature of the unemployment problems frequently affecting the industry. Taking all this into account, the adoption of action at the sub-sectoral level before the formulation of a sectoral policy seemed to be a reasonable risk.

Three groups of measures were considered, roughly corresponding to the three categories in which the facionista textile industry of the region may be grouped.

For the highest category in this type of industry, it was considered that there were good prospects for a gradual improvement, mainly in entrepreneurial capacity, technological level and plant size. This would be achieved either (a) by continuing the facionista activities while increasing the scale of production, modernizing the internal organization and equipment, modifying the production lines and, in particular, forming groups and adopting co-operative action to acquire raw materials, market their products, etc.; or (b) by creating the necessary conditions to convert the facionistas into genuine manufacturers, who would purchase their own raw material and seek their own markets, with all the changes that this would imply in operational methods and equipment and increased financial requirements (e.g., working capital, which is obviously not very large in facionista activities). Various types of financing, incentives for the merging and concentration of enterprises, and technical assistance parallel with the financing and merging operations were provided for this first category of operations.

However, not all facionista establishments are able to attain a minimum level of success through an assistance programme of this kind. Such a programme is feasible only in the case of those with a greater entrepreneurial capacity, which, as has been demonstrated by studies carried out in the area, are only a minority. The majority of cases are in the opposite position: enterprises whose recovery is more difficult owing to their small scale of operation (there are dozens of units with less than 10 looms) and the entrepreneurs' lack of organizational, technological and other experience. At this low level of productivity and efficiency the problem lies in finding economically effective but human methods (that is, based on market mechanisms and indirect means of encouraging or discouraging certain natural impulses without using coercion) of channelling the manpower employed in this category into more productive activities and instituting a system of paid employment in efficient up-to-date plants, instead of maintaining the system of "entrepreneurs" whose advantages are completely

/illusory, as

illusory, as has been proved beyond doubt 24/. Different measures are called for in order to facilitate and perhaps partially subsidize the transfer of manpower rendered redundant in this sector of the facionista industry to other activities.

Three basic instruments were established to achieve this objective. First, financial support and technical assistance to enable former facionistas to initiate other activities of a type which can be carried out on a small scale with a moderate level of technology. Clearly, such action on its own would not be decisive in solving the problem, in view of the relatively stiff requirements in terms of entrepreneurial capacity and the technological and market limitations which former facionistas would have to face. Whether or not this instrument is successful depends directly on the volume and quality of technical assistance which can be mobilized in support of the desired changes in the entrepreneurial system 25/. A second instrument designed to encourage or facilitate the mobilization of the scarce financial resources of the small-scale facionista manufacturers and to reorganize the inventory of textile equipment in the area consists of a programme for the purchase of obsolete equipment still in operation (mainly looms) for conversion into scrap. It is imperative in such a programme to enforce the strict observance of legal norms prohibiting the purchase and sale of obsolete textile equipment 26/.

The financial resources which the facionistas would obtain from the sale of their equipment would be used to finance their new activities, supplemented by funds provided by the State of São Paulo.

24/ It was found in on-the-spot investigations that a family-type facionista enterprise in which three or four members of the household work on a permanent basis generally obtains, under what are considered normal market conditions, a total income which is below or scarcely higher than the normal wage that a single member of the family could earn as a weaver in a modern plant. Whenever there is a slump, which happens frequently, the situation becomes even worse (no account is taken here of the lack of returns on the admittedly scanty capital invested in the facionista enterprise).

25/ Early in 1971 the Banco de Desenvolvimento do Estado de São Paulo established a Productivity Centre in the city of Campinas, near the Americana region, mainly to provide technical support for the Americana Programme.

26/ This is not so easy, since the definition of obsolescence is not entirely free from difficulties, and tax inspectors could not apply it indiscriminately. Neither should the purchase and sale of second-hand equipment be completely banned, since such equipment may have a part to play in industrial development.

/The third

The third instrument for removing those unable to survive in facionista activities would be to encourage the installation of efficient up-to-date textile plants of large or medium size (in the latter case, equal to or larger than the minimum economic size for the type of product to be manufactured), either in Americana or within a radius of not more than 40 to 50 kilometres in the surrounding district. These units would absorb part of the surplus manpower, which would be familiar with weaving operations 27/ but would require additional specialized training. They could also absorb a proportion of the financial resources of former facionistas obtained from the sale of obsolete equipment, partly for scrap, which would represent their contribution to the capital stock of the new enterprises. They would naturally hold a minority share, given the size and nature of the proposed new enterprises, but their interests and the savings of small investors in the region would be protected, among other means, by the participation of BADESP in the new enterprises.

Lastly, there remains an intermediate category of some 400 facionista enterprises comprising all those which could not immediately be classified, without risk of error, in either of the two previous categories: enterprises which are clearly recoverable as regards operating in the textile sector itself, and enterprises which are probably irrecoverable as regards entrepreneurial activity in the textile sector but which may be converted into other small-scale activities or be absorbed on a wage-earning basis in efficient up-to-date units in the textile sector. The intermediate category, which is possibly the largest, will slowly react to market pressures and the effects of the various measures referred to above, while the possibilities of recovery or conversion are duly explored. In other words, in time every facionista now operating would find his way into more productive activities, with the help of incentives, technical assistance and public and private development projects. Some would strive for improvement in the same field (in view of the present conditions, the improvement would have to be truly considerable); other would opt for conversion, while retaining the status of entrepreneur (in adequately efficient small-scale activities); and others would simply shift to paid employment in efficient up-to-date plants.

The purpose of this brief description is to give an illustration of a programme for the reorganization and modernization of industry. The implementation of a programme of this kind (adapted, of course, to the particular conditions prevailing in the industry and region concerned) often constitutes an essential factor of technological change, and indeed a basic requirement for the successful transfer of technology from abroad, both of which points are dealt with in the following sections.

27/ The following types of plants would be established: integrated spinning and weaving operations, specialized weaving mills, and plants using textiles as raw material (mainly clothing factories, which use a considerable amount of labour per unit of product and per unit of capital).

4. The transfer of technology in the establishment and development of industry

An ECLA study 28/ has analysed the transfer of technology from the boom period of the establishment of textile enterprises in Brazil, between 1880 and 1905, to the present day.

Until nearly 1920, the establishment of a textile mill took place through a block transfer, rather similar to the turnkey contracts which countries in the early stages of industrial development still conclude today in the more complex sectors of technology. "Whole mills were transplanted from England, the only country that had equipment for export. These mills were installed complete with not only production equipment and auxiliary plant, but also structural supports for the buildings themselves, i.e., the metal columns and beams that supported the roof." The equipment transplanted in this form was generally second-hand, owing to the gradual modernization of the United Kingdom's own production resources 29/.

The technicians needed to install and maintain the mill in operation were also English, by a tradition which had already grown up in this sector. This practice of importing English technicians for the Brazilian textile mills, and probably those of other Latin American countries, lasted up to the beginning of the Second World War.

In view of this integral transfer of technology, it is of interest to see why the national textile industry accumulated so many structural defects and in more recent years, sank to such low levels of operational efficiency, as mentioned earlier. This may have been the result of the existence of obstacles to proper transplantation of the technical techniques of industrial operation or it may have resulted from a lack of satisfactory linkage between the operation of industry and its administrative, financial and directorial organization, synonymous with a lack of entrepreneurial capacity, due to the fact that "for a long time, textile manufacturers were textile merchants who, being

28/ ECLA The transfer of technical know-how in the textile and clothing industries in Brazil (E/CN.12/919), September 1971.

29/ In actual fact, from the first quarter of the twentieth century there were other possible foreign sources for the acquisition of equipment, including notably the Swiss manufacturers. Even so, the economic and political relations which still prevailed made Great Britain Brazil's almost exclusive supplier.

familiar with market needs and demand patterns, and having accumulated profits in their commercial activities, decided to embark on an industrial venture" 30/.

It is difficult to give a clear reply to these questions without going into the historical development of the textile industry in Brazil 31/. In the present period, i.e., the period which began with the Second World War, technical assistance as an integral part of the sale of equipment continued to be the main method for the transfer of technology in the Brazilian textile industry, although it is now combined with some other complementary procedures, imposed by the development of the industry, which show an increasing tendency to take a greater share in the overall advance of the transfer of technology.

In fact, the increased technological complexity of the operations and equipment, resulting from the speeding-up of technological progress in the textile industry in the last twenty years, and the considerable increase in the minimum economic size of manufacturing units make necessary large volumes of capital and increase the entrepreneur's risks; these factors have changed considerably the transfer of technology in the textile industry.

30/ ECLA, op. cit., pp. 37 and 38. The commercial origin of a large part of industry, especially medium and small industry, is certainly not exclusive to the textile industry since it appears in other branches too. For example, the small paper manufacturer in Brazil is not, in the great majority of cases, a professional in paper, with a subjective urge to fight for supremacy in the market through the prestige of his brand or the quality of his product. He is essentially a business man who has invested resources in a specific branch of industry and who hopes objectively that they will be remunerative within the general context of the business transactions in which he may engage. His lack of know-how on the intrinsic nature of the industry in which he is engaged (in general not exclusively) does not permit him to assess the advantages of rationalizing his industrial operations. (Leone Associados, Relatório da pesquisa sobre a estrutura brasileira de produção e consumo de celulosa e papel. Rio de Janeiro, 1968, pp. 207 and 208.)

31/ Some studies have been made on the historical development of this industry in Brazil, among them in particular Stanley J. Stein, The Brazilian Cotton Manufacture: Textile Enterprise in an Underdeveloped Area, 1850-1950, Harvard University Press, Cambridge, 1957. Any review of these, however, lies outside the bounds of the present study.

In its analysis of the transfer of technology in the textile and clothing industries, the ECLA study takes separately the cases of installation of new mills, restructuring and modernization of obsolete mills, and utilization of special processes necessary only in one or more stages of the process of production. In dealing with each of these cases, it uses a classification of the different categories of technical know-how little different from that presented and reviewed in chapter II of the present paper 32/.

The situation of each category of technical know-how, according to its origin and manner of transfer in the installation of new mills, is summarized below.

At the stage of the selection of the production process and equipment, the technical know-how required by the entrepreneur almost always comes from the machinery manufacturer. Since the manufacture of textile machinery in Brazil increased after the Second World War, however, this technical know-how does not necessarily come from abroad. Indeed, a considerable part of the machinery installed in Brazil in recent years includes machines and equipment of national manufacture, mainly destined for small and medium plants. The big mills generally import their equipment because of the absence of equipment of national manufacture; of course, the technological advance represented by such imported equipment usually goes beyond the stage reached in modernization, re-equipment and expansion by the average mill.

Once the production scheme of the future factory has been determined in the feasibility study, the entrepreneur, on his own initiative or through a consultant, invites several manufacturers to make bids for the supply of the equipment. "The production process may be decided ab initio by the nature of the product chosen, and there may be no question of choice as regards equipment if the production process is protected by a patent." In any case, "the manufacturer plays an important part in the transfer of know-how, for to defend his machinery, he is obliged to enter into detailed explanations concerning the production process, to analyse its advantages and disadvantages and compare it with rival processes. In fact, this is the only really effective manner of transferring know-how, since it enables the entrepreneur and his technical staff to keep their knowledge of production techniques up to date" 33/.

32/ The main difference lies in the separation, as regards the regular operation of the mill, of technical know-how relating to quality control of the raw materials, intermediary products and finished products from know-how on the preventive maintenance of the machinery, since it is considered that these are basic aspects of the textile and clothing industries which pose their own problems as regards the transfer of the respective technology.

33/ ECLA, E/CN.12/919.

The fact that the manufacturer of machinery and equipment continue to be the main source of specialized know-how on production techniques and even on current industrial operations gives rise to some problems which are hard to solve in the present situation in Brazil.

Many entrepreneurs do not possess sufficient technical capacity to make a satisfactory appraisal and assessment of the different offers submitted by manufacturers or to be able to convert technical data into the equivalent economic estimates and financial programming. Hence the need to have recourse to independent consultants specializing in technical, economic and industrial organization problems, in order to make up for this lack. However, various difficulties stand in the way of having available a sufficient number of suitable consultants. Not the least of these is the inadequate development and the relative technological precariousness of the manufacture of textile machinery and equipment in Brazil. The development of this industry on a larger scale would make possible the permanent training of high level technical staff and the setting-up of an entire support system for the textile sector as regards analysis of and experiments with materials, research, the introduction of new materials, standardization, etc. Both these aspects would make a considerable contribution to the expansion and consolidation of the local advisory and consultant services in textile matters.

Moreover, if Brazil were to step up the manufacture of the machinery and equipment needed to expand and renew existing textile mills, it would probably create, through the indirect effects already mentioned, favourable conditions for raising little by little the technological level of the whole textile industry. It may, however, be asked whether it would be a viable proposition, within the context of the country's present economic policies, to satisfy a high proportion of the annual requirements for the renewal and expansion of textile machinery with national machines and equipment.

A categorical answer to this question is not easy. A basic element of present official policies is that national industries should be able to compete on international markets and thus gain external outlets; the equipping or renewal of equipment of textile mills must therefore take place under conditions of technology and capital costs which are at least approximately comparable with international conditions, and this excludes from the start any policy for developing the manufacture of textile machinery which reserves markets, restricts imports or establishes prices for national equipment appreciably higher than those prevailing on the international market 34/. A surcharge margin could be allowed for national equipment vis-à-vis imported equipment, but only to the extent to which it would be made up for by reduced labour costs.

34/ A valid comparison, for the purposes under consideration, is between national prices in the factory and FOB prices for imports of similar equipment.

/To achieve

To achieve the comprehensive manufacture of machinery, constantly advancing technology and fully competitive internationally, is certainly an ambitious goal, on which this study is hardly in a position to pass judgement. However, if the re-equipment and replacement programmes are stepped up, the accelerated growth of the gross national product continues as in recent years, and the considerable fiscal incentives to export are maintained, then the size of the machinery and equipment market would seem to fully justify the development of the national manufacture of textile machinery and equipment, including part of the wide range of necessary technological variants, on a scale in keeping with the minimum economic sizes of the respective production series, complemented by the importation, free of customs duties, of equipment which has no national equivalent. It would therefore be indispensable to determine the varieties of equipment of less technological complexity and wider market which should be manufactured in the country itself, and the technologically more advanced and more diversified machinery and equipment which should be imported.

All policies aimed at expanding the national manufacture of textile machinery and equipment (or simply at redefining aims and goals), however, require the indispensable complement of long-term continuity in the elements composing it, even where restrictions on exports are concerned (either by licensing, differentiated exchange rates or tariff barriers), in order to avoid the temporary collapses of the machinery market which are the usual result of massive imports. The lack of continuity here has been very detrimental to the development and consolidation of the textile industry.

The example of Japan shows that there is no obvious association between the development of the textile manufacturing industry and the manufacture of the machinery and equipment used by it. The Japanese textile industry began production in a State mill, set up with machinery imported from the United Kingdom in 1867, supplied its domestic market and began to export at the end of last century. In 1933, the Japanese textile industry took first place as exporter on the world market, replacing the United Kingdom. It was only in 1922, however, that Japanese production of textile machinery and equipment began, and it achieved a considerable scale only in the 1930's. Thus, for half a century the machinery and equipment of the Japanese textile industry depended almost exclusively on imports. The same deliberate policy of avoiding the premature manufacture of machinery and equipment and making the most of imports of equipment under favourable conditions from a foreign market subject to growing competition, and offering high-yield products, was applied to the machine-tool industry, which has only in recent years shown any appreciable degree of development in Japan although to a notably lesser extent than that observed in other engineering sectors no less complex and certainly of greater capital-intensity (shipbuilding, manufacture of heavy electrical equipment, etc.).

/The foregoing

The foregoing covers the main aspects of the installation of new textile mills. Consideration will next be given to the transfer of technical know-how necessary for the restructuring and modernization of obsolete mills 35/.

Technical know-how is required in connexion with four main aspects:

(i) The reformulation of production programmes in line with the new requirements of the market, in view of the tendency of small and medium mills to maintain lines of products already supplanted through technological progress or the evolution of consumer preferences 36/. This reformulation involves the introduction of new products with superior qualities or qualities better adapted to the requirements of the consumers.

(ii) The rationalization of production and the simplification of the intermediate operations. This is closely associated with the modernization of plant, but is not always dependent on such modernization, and in addition requires specialized technical know-how different from that required in connexion with the equipment.

(iii) Modernization or replacement of plant considered to be obsolete (either because of age and corresponding physical wear, or because of technological obsolescence) and new disposition of plant. This should not be confused with the last heading (rationalization of production).

(iv) Setting up of systems for the control and review of management methods, including in particular the programming of production in close association with the available machinery, the optimum conditions for its use, and the present and foreseeable requirements of the consumer market.

These four aspects, which are of fundamental importance for the reorganization and modernization of the textile sector in view of the size to which it should grow in Brazil, pose a difficult problem as regards technical know-how and its possible origin. The necessary reorganization measures, by their very nature, take the form of advisory activities and technical consultant services. Activities of this type provided by Brazilian firms are extremely limited, since these firms prefer to devote themselves to the preparation of economic viability studies and

35/ See ECLA, E/CN.12/919, op. cit.

36/ A typical case is that of the facionista textile mills of the Americana region, which continue to produce textiles using rayon fibres, although the consumer market for these fibres is at a standstill, if not in actual decline.

to a lesser extent to technical viability studies (the latter with the temporary aid of foreign technicians) for the establishment of new mills. Advisory services for the reorganization of existing mills require another type of know-how, much more detailed in its operational and technological aspects, and very specific know-how in matter of location, markets, etc.

The difficulty lies in the fact that there are practically no national consultant enterprises capable of providing advisory services in a wholly satisfactory manner: there is only a small number of individual consultants, subject to all the limitations arising from the individual nature of their activities. Nor is it easy to solve the problem by transferring technical know-how from abroad through firms in other countries, whether or not they are associated with national consultant firms.

The fact is that the number of foreign firms with experience in reorganization and modernization is small, because of the lesser importance of these problems in the industrialized countries 37/, and moreover their experience and criteria have grown up out of the local conditions under which they have been called upon to operate, and these are extremely different from those of Brazil. There can be no doubt that in order to set up a new industrial enterprise, it is necessary to adjust abstract technical and economic data to fit local conditions closely. Since operations of mass reorganization and modernization are almost always much more specific in character, they require a much more intensive effort to adapt objective data and attitudes. Hence the transfer of foreign technology in the reorganization and modernization of the textile sector in Brazil, despite the large-scale possibilities offered, gives rise to problems of viability whose solution will probably be a difficult and lengthy matter. A first step in this direction was the setting-up of Regional Productivity Centres on the initiative of the Development Bank of the State of São Paulo, mentioned above, since these Centres both provide technical assistance for the small and medium enterprises with their own human resources, and also aid the preparation, through the operations of the Taxpayer Support Fund, of broader-based assistance projects to be implemented by specialized firms under the supervision of these centres and within the context of the sectoral strategy defined by them.

37/ In these countries, modernization is a gradual process, part of a constant adaptation of the enterprises to technological development, to the markets for their products, and to the prices of factors. Operations for mass replacement of equipment and the corresponding reorganization have only been observed in a few cases (e.g., in Great Britain after the Second World War), and even then under entrepreneurial and institutional conditions completely different from those of Brazil.

/Lastly, the

Lastly, the ECLA study mentioned earlier considers the forms of transfer of technology from abroad which specifically include the utilization of special processes or synthetic raw materials. This category includes the introduction of new products through the use of new raw materials (synthetic fibres or combinations of these with natural fibres) or better finishing of textiles through the use of new auxiliary chemical products or special equipment for the application of particular processes. Methods or processes for treating finished products or producing raw materials are very carefully protected by patents throughout the world, and even the trademark may only be used through licensing agreements between enterprises. It is in the utilization of special processes that these agreements between enterprises are most frequently found as a means of transferring technology, and where the problems, including cost, acquire greatest importance.

The study enumerates the following main cases of transfer of technical know-how in connexion with special processes, which illustrate and explain the operation of the respective agreements:

- (i) Utilization (under the conditions for use of the trademark) of synthetic raw materials covered by well-known registered trademarks;
- (ii) Utilization (also under the conditions for use of the trademark) of special patented equipment to obtain a product with special characteristics;
- (iii) Licensing agreements for the utilization of special patented processes which give the textile better qualities (pre-shrink, non-crease, waterproof, self-adhesive, etc.);
- (iv) Utilization of auxiliary chemical products which improve the quality of the textiles or increase the efficiency of processes;
- (v) Agreements between enterprises for the granting or exchange of designs for printing or embroidering textiles, and patterns for the clothing industry.

The present document will not repeat the explanations given in the above-mentioned study on the practical arrangements for applying or operating the agreements, which are very detailed and are different in each case; the reader is referred to the original study, where this topic is dealt with in greater detail 38/. In the next section, a brief summary will be made of the main problems arising from the practices followed as regards granting licenses and transferring technology through agreements between enterprises.

38/ ECLA, E/CN.12/919.

5. Main problems arising from agreements between enterprises as applied in industry

Chapter V reviewed some aspects of the transfer from abroad of textile technology which can be approximately quantified, e.g., as regards the number of contracts, the categories of technical know-how imported, the payments made abroad for know-how, the external origin of the technical know-how obtained, etc. In this last part of the present chapter, other aspects more difficult to quantify will be reviewed, in order to complement the analysis mentioned.

An estimate of the cost of transferring technical know-how from abroad for the Brazilian textile industry must take into account three main categories of transfer: licensing agreements, technical assistance in the installation of entire mills or groups of machines, and the straightforward sale of products, generally synthetic fibres, the prices of which implicitly incorporate a specific payment for the technical know-how and for the use of registered trademarks.

In the first category are grants of rights to apply special technical processes to textiles, whether or not they include the sale of equipment and the right to use registered trademarks. The payment for the technical know-how takes the form of royalties charged at a specific rate, not ad valorem, on each metre of fabric produced by the firm which has been granted the license, regardless of the cost of the final product. Unlike the usual practice in other industries, this procedure means that the more expensive the product, the lower the cost of the process to the manufacturer of the fabric. This encourages a policy of high prices. Two specific examples are mentioned in the study; one of these, in addition to the royalty of approximately 0.25 US cents per metre on a certain minimum production, contains the added obligation to purchase whatever machinery is required, manufactured by third parties, through agreements with the licensor enterprise, while in the second example, the equipment is not purchased but rented to the licensee for the period covered by the contract (three years) on the basis of a lump-sum payment (the amount of which could not be determined) plus a royalty of 0.5 to 1 US cent per metre, according to the nature of the product 39/.

39/ ECLA, E/CN.12/919, op. cit. The processes involved in licensing agreements in these two cases are treatments for fabrics: the first for stabilizing the dimensions (pre-shrinking) and the second for the coating of fabrics with a layer of some other material, generally synthetic.

The second category covers the provision of technical assistance, mainly by machine manufacturers. This includes the assembly and adjustment of the machines, preliminary testing, and periodic overhauls and adjustments. In theory, it is free, because it is included in the price of the equipment; the customer only pays the travel expenses of the specialized staff provided by the manufacturer to assist him. This is naturally a result of the keen competition on the world market between suppliers of textile machinery. There is, of course, an implicit cost to cover this form of technical assistance included in the price of the equipment, but the intensity of the competition probably keeps such costs down 40/. Where a completely new plant is installed and the technicians sent by the manufacturer remain at the plant after all the machinery has been installed so as to familiarize the local staff with the handling and adjustment of the different machines, the cost of this type of technical assistance may be estimated at approximately 4 to 6 per cent of the total cost of the equipment.

The third category includes the use, mainly in the synthetic fibres branch, of a permanent trademark protected by strong publicity campaigns, combined with the compulsory use of certain raw materials and auxiliaries, under the technical direction of the supplier of the trademark (and of the materials). In such cases, no charge is made for the technical services provided by the supplier, despite the magnitude and complexity of the technical guidance necessary, in the case of synthetic fibres. The price of such services is included in that of the raw material or intermediary product, and it is difficult to estimate what percentage of the total cost of the product it represents, but the oligopolistic features of the production of synthetic fibres should be remembered at this point. This topic is analysed in the study mentioned, where particular mention is made of the problem of the competition between synthetic fibres and Brazilian raw materials, which are natural fibres, and of the fact that the price ratios involved in Brazil and other developing countries are much less favourable than in the industrialized countries. A comparison between the United States and Europe on the one hand, and Brazil on the other, for example, gives a ratio of one to three.

Another point worthy of mention is that, according to the percentages applied by the Central Bank when registering technology transfer in order to estimate the income to be taxed and the limits of the remittances abroad, a limit of 4 per cent is imposed on the textile industry in cases of technical assistance agreements or agreements granting licenses for processes and products, whereas this limit drops to 1 per cent in the case of the use of trademarks, i.e., when the use of the trademark or trade name does not derive from the utilization of patents, processes or manufacturing formulas (see chapter IV, section 6).

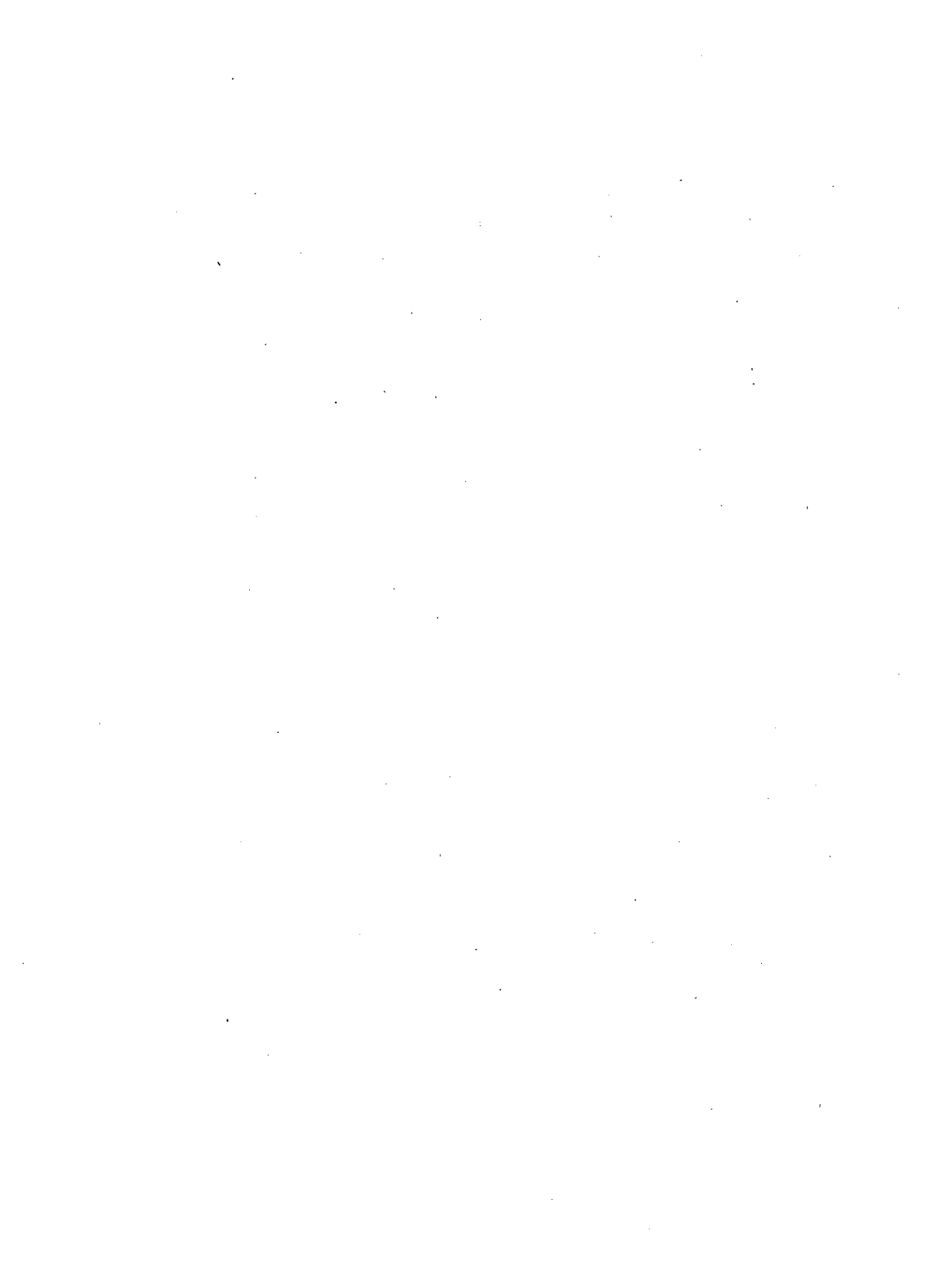
40/ Another contributory factor is that this technical assistance is in the form of mechanical know-how which is not protected by patents, but on the contrary is quite widely disseminated in the industrialized countries.

Lastly, mention may be made of a general conclusion reached in the sectoral study on the transfer of technology in the textile industry. "The industrialized countries are trying to force the under-developed countries to consume synthetic textiles at a price that is higher than their real relative price; this is because production is dependent on imported inputs whose prices are controlled in the countries of origin, with the additional drawback that consumption of such inputs is prejudicial to the economic activities based on natural fibres." ... "The developed countries have a natural protection against this type of agreement, in their own level of technology and their own marketing techniques, since they compete in the same market. The developing countries, on the other hand, can only protect themselves with special regulations." ... "The entry of patented processes relating to the finishing of the textiles should be discouraged or restricted when their only merit is the reputation of the trademark, and also the use of processes that encourage the consumption of imported raw or ancillary materials, licensing agreements for the use of designs which boil down to the use of a trademark, and other agreements of the same kind 41/."

One last brief comment may be made on this subject. It cannot be denied that international trade in synthetic fibres takes place under conditions of monopoly or oligopoly; such situations of limited or non-existent competition are only temporary, however, and are basically subject to change as a result of technological innovations, changes in the size of the market (and similarly, in the economies of scale of the new processes) and the relative prices of the factors in the countries participating in this trade 42/. It is therefore necessary to increase negotiating power in order to obtain licenses, investments and imports, and this can be achieved in part through the institutional changes described in chapter VI, section 5. Any review of the problem of synthetic fibres versus natural fibres in the context of a short-term industrial policy, however, should take into account the factors mentioned and be based on some idea of future tendencies as regards technology, production scales, and prices relating to factors of production throughout the world. In short, there should be an attempt at technological forecasting and industrial planning for the next twenty years.

41/ ECLA, E/CN.12/919, op. cit.

42/ See G.C. Hufbauer, Synthetic Materials and the Theory of International Trade, Harvard University Press, Cambridge, Massachusetts, 1966.



Chapter VIII

THE TRANSFER OF TECHNOLOGY AND INDUSTRIAL POLICY IN A CAPITAL GOODS INDUSTRY

1. General situation of the machine-tools industry

The special study on the transfer of technical know-how in the machine-tools industry 1/, and other earlier studies on the same industry 2/, indicate that the industry has a complex and heterogeneous structure that does not favour the rapid introduction of the technology available on world markets.

Furthermore, certain methodological studies undertaken by ECLA 3/ have helped to shed light on some important aspects of the trends of the machine-tools industry at the different stages of industrial development.

This chapter will begin by looking at the current situation of the industry in terms of technological levels and entrepreneurial structures, and then examine the role played at present by foreign technology as regards foreign investment and licensing agreements.

The IPEA study, which brought up to date ECLA's earlier research work on the subject, gives the following table of enterprises producing machine tools, classified by number of persons employed in 1968:

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- 1/ ECLA, "The transfer of technical know-how in the machine-tools industry in Brazil", op. cit.
 - 2/ ECLA, "The machine-tools industry in Brazil" (E/CN.12/633); IPEA, A indústria de máquinas ferramentas (Rio de Janeiro, April 1970).
 - 3/ In particular the document entitled "Methodological problems relating to the programming of development of the machine-tool industry in developing countries" (CID/SYMP.D/C.11) prepared by ECLA for the Inter-Regional Symposium on the Development of Metal-Working Industries in the Developing Countries (Moscow, 7 September to 6 October 1966).

/Persons employed

Persons employed		Number of establishments, by total number of persons employed	Number of establishments, by number of persons engaged in machine-tools manufacture
Over	1 000	3	1
500	to 999	2	-
250	to 499	2	3
100	to 249	14	9
50	to 99	13	12
25	to 49	16	14
10	to 24	15	19
Up	to 9	6	13
	<u>Total</u>	<u>71</u>	<u>71</u>

The total of 71 corresponds solely to enterprises devoting 5 per cent or more of their activities to machine-tools manufacture. If other enterprises devoting less than 5 per cent to machine tools are included, the total rises to 80.

The IPEA study indicates that, if the employment structure in 1968 is compared with that prevailing in 1961, it is found that the number of enterprises producing machine tools fell from 90 in 1961 to 80 in 1968. Furthermore, over the same period the number of enterprises devoting between 75 and 100 per cent of their activities to machine-tools manufacture fell, while that of enterprises devoting between 5 and 49 per cent rose.

These data show clearly that the structure of the sector has many shortcomings, since not only are there not enough enterprises of the most usual size, but there has also been a decline in the specialized manufacture of products specific to the sector, which may be attributed to the fact that some enterprises have diversified production in order to be less at the mercy of fluctuations in the demand for machine tools. This is not something new, but has been a regular feature in recent years, precisely when one might have expected specialization to increase as a result of the rapid growth of needs in the industries using machine tools.

However, although these enterprises have become less specialized, their average size increased between 1961 and 1968, and an increase is also to be observed in the amount of labour engaged exclusively

/in machine-

in machine-tools manufacture. Thus, the numbers of workers per establishment exclusively engaged in machine-tool manufacture rose from 53 in 1961 to 80 in 1968 4/.

Despite this increase in the number of persons employed, however, the size of establishments is still too small in international terms, since the average number of employees in medium-sized establishments is only around 500.

As the IPEA study indicates, in the specific case of the machine-tools industry, the size of productive units is important because large enterprises have greater possibilities for creating and adapting know-how, rather than because of any reduction in costs as a result of increases in scale. This is particularly the case in machine-tools manufacture because any reduction in cost flowing from an increase in scale is offset by the fact that machines are as a result less adaptable to the specific needs of users and are hence less productive for certain activities 5/.

The low ratio of technicians with a medium or high level of training to the total number of persons employed is another factor that reflects the current technological inadequacy of the machine-tools industry. The increasing need for technicians, draughtsmen and specialized engineers for the technological and functional renewal of enterprises in the course of development makes for a high ratio between indirect personnel and the size of the enterprise in a technologically modern plant. But the somewhat smaller enterprises that are the norm in Brazil are incapable of absorbing the amount of skilled manpower that their technical services require.

While in the world as a whole indirect personnel account for around 40 per cent of the total number of personnel employed in the sector, in the Brazilian machine-tool industry the figure is not more than 24 per cent 6/.

The IPEA study reveals that 47 (or 66 per cent) of the 71 enterprises considered did not employ qualified engineers in 1968

4/ The increase is much less pronounced if the figures for enterprises and persons employed in the large units, employing over 1 000, are excluded; the average size then falls to 40 persons per establishment in 1961 and 57 in 1968.

5/ In this connexion, see ECLA, "Criteria and background for programming the machine-tool industry" (CID/SYMP.D/C-4 - E/CN.12/L.15, February 1967).

6/ Excluding the single enterprise employing more than 1 000 workers, which is at quite a different technological level from the rest of the industry.

and 28 (close to 40 per cent) employed neither engineers nor draughtsmen. This confirms that the industry lacks the kind of skilled manpower that it needs to develop new know-how and to improve its capacity to absorb and select foreign technology.

To conclude these considerations on the machine-tools industry, it is appropriate to refer again to the IPEA study. The study states that the above figures become even more alarming if a quantitative analysis is made of skilled manpower. In the 24 enterprises employing qualified engineers the total number employed is only 49, distributed among owners, their children, and others; while the 40 enterprises that have draughtsmen employ a total of only 121. The number of technicians in the national machine-tools industry accounts at present for 21 per cent of the total labour force of the industry. If the industry is to improve its level of technology and efficiency, it must increase three- or four-fold the proportion of engineers and draughtsmen it currently employs (6 to 8 per cent).

2. The structure of the industry and the transfer of foreign know-how

What role has been played by imported technical know-how in the creation and recent development of the industry? This is a question which has been examined at length in the ECLA study on the transfer of technical know-how in the machine-tool industry 7/. The paragraphs that follow refer to some of the conclusions of this study and of the IPEA study that are aimed at facilitating the transfer of technical know-how from abroad to assist in the urgent and essential task of modernizing and restructuring the industry 8/.

Technical assistance contracts and licensing agreements have not played a very important role in the Brazilian machine-tool industry. Recent information indicates that the industry contains only two subsidiaries of foreign companies, and that there are only seven manufacturing licenses in effect, which would not exert any great influence on the industry as a whole. The contribution of technical know-how of foreign origin in 1968 was about 10 per cent of a national production range comprising 160 types and models of machine tools 9/. It may thus be said that the analysis made in

7/ E/CN.12/920, op. cit.

8/ For the purpose of restructuring the industry, a set of measures have been adopted that form a 'sectoral programme' for reorganization and development now under study by the Ministry of Planning and Co-ordination.

9/ These data come from the IPEA study, which covers the period 1969-1970. Some changes are beginning to be felt at present.

the text of the past trends of the sector gives a fair picture of the efforts it has been making 10/.

According to the IPEA study, there are 11 machine-tools enterprises that import technical know-how, three of which are subsidiaries of foreign enterprises and one of which supplies technical know-how and assistance to other manufacturers. The Federal Republic of Germany heads the list of suppliers of know-how (10 agreements), followed by the United States (2 agreements), and France, Switzerland and the United Kingdom (one agreement each) 11/.

Since little know-how is generated by the Brazilian engineering industry, the fact that there are few agreements with foreign companies is a further factor that makes for weakness in the machine-tools industry. An examination will be made of the most likely causes for this, and then of the action programme proposed for remedying it and the role assigned in this programme to transfers of technology from abroad.

First of all, it should not be assumed that the current low level of technical know-how in the machine-tools industry in Brazil is due to obstacles of a legal or administrative character limiting the transfer of know-how from abroad. Not only is Brazil's policy as regards technical assistance agreements and licensing arrangements quite liberal, so that such obstacles do not exist in practice 12/, but also various other sectors of industry have reached a comparatively high level of technology, even as regards engineering products 13/.

A more likely explanation for the situation may be sought in the historical origin of machine-tools manufacture in Brazil, which started with repair activities, sometimes of artisan type, and gradually grew to include increasingly ambitious objectives of actual manufacture, based for the most part on the simple copying of imported models that were not technologically advanced and therefore easier to produce. This gradual rise in the level of engineering activities which eventually came to form the national machine-tools industry is also attributable to the rapid dissemination of machining techniques, based on activities

10/ E/CN.12/919, op. cit.

11/ IPEA, op. cit.

12/ See chapters IV and VI of the present study.

13/ This can be inferred from a study of the technological level of a large number of sectors and subsectors of the engineering and electro-mechanical industries, contained in a recently completed study by F. Vidossich entitled "Áreas estratégicas e desenvolvimento tecnológico nas indústrias eletro-mecânicas no Estado de São Paulo" (August, 1971).

concerned with the repair of machinery and equipment, and to the fact that most users of machine tools made few demands as regards technical standards and efficiency.

A further factor is the virtually total lack of foreign investment in the sector, which can be attributed to the fact that the market is extremely fragmented and was not very demanding during the twenty years following the Second World War.

Some of the basic aspects of this situation are probably changing at present - for example the structure of demand is changing as a result of the establishment of the motor-vehicle industry in the 1950's and the prospects for rapid growth in both the total market and the markets for the principal machine tools - but the actual restructuring of the industry will still depend on the adoption of a set of official policies that for the most part would favour stepping up the foreign contribution to technology in the form of technical assistance agreements, licensing arrangements and also foreign investment in association (preferably a minority shareholding) with groups of Brazilian entrepreneurs 14/.

3. Future prospects for the absorption of technical know-how in the industry

Only one of the 71 enterprises making up the industry in 1968 was in a position to contract services abroad and to absorb all the technical know-how it received in an efficient manner. A further 15 enterprises were not in a position, owing to level of technology or size, to absorb know-how so efficiently, but they did have the minimum amount of capability to establish relations with foreign companies and enter into technical assistance agreements or licensing arrangements, or both. The remaining 55 enterprises were not in such a position, and hence in principle were not able to benefit from transfers of technology from abroad 15/.

As regards these latter enterprises, the solution would consist in strengthening official research institutions in the field of machine tools and engineering production in general, while at the same time creating machinery to facilitate access

14/ Another very important factor which would promote technological modernization would be the application of measures to make the market for machine-tools more stable. This issue, which is not peculiar to the machine-tools sector, is examined at the end of the present paper, for it is an essential component of an effective industrial policy.

15/ F. Vidossich, "Áreas estratégicas e desenvolvimento tecnológico nas indústrias eletro-mecânicas no Estado de São Paulo", op. cit.

by the industry to such institutions, for example by the creation of industrial information services, the establishment of "supervised" credit arrangements (i.e., credit combined with the provision of technical assistance), and fiscal and credit incentives for reorganizing and modernizing enterprises as regards both administrative and organizational aspects and technology 16/.

In brief, it may be said that in practice it is not necessary to resort to foreign technical know-how in order to install new plant or expand existing plant 17/. As regards the technical know-how required for the current operation of such plants, various of the existing shortcomings could be largely rectified by means of measures to disseminate the technical know-how acquired by the few relatively more efficient enterprises, supplemented by an intensive and well-oriented effort to keep industry informed 18/.

Nevertheless, there is a high degree of dependence on foreign suppliers as regards technical know-how relating to product conception and design (new models of machines, in line with a gradual expansion of the market and also with the growing needs of a rapidly expanding industry), and also as regards the method of access to improvements made at a subsequent stage. The ECLA study on the transfer of technical know-how in the machine-tools industry contains a detailed analysis of the new types of machine that are not manufactured in Brazil and that the industry should include in its production ranges by 1975 in order to maintain current market trends, i.e., to maintain its current share in apparent national consumption. This study evaluates the probable distribution of national and imported design know-how in the period 1970-1980 19/. The figures given are as follows:

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- 16/ In connexion with the role of official research institutions in raising the level of technology of the machine-tools industry and the principal subsectors of the electro-mechanical industry, see F. Vidossich, op. cit., chapters V and VI. A somewhat less detailed examination of the relationships between applied research and industry in other (European) industrial sectors can be found in O. Nienzle et alia, The promotion of the relationship between research and industry in mechanical production (CIRP, 1966).
- 17/ Here installation and expansion of plant is taken to exclude all other aspects of know-how, such as product design, etc.
- 18/ On this issue a number of practical suggestions are offered in N.F. de Figueiredo, Subsídios para a estruturação de uma política científica e tecnológica (1970), chapters III, VI and VIII.
- 19/ ECLA, E/CN.12/920, op. cit.

Complexity of machines	Number of machine designs	
	National	Imported
Low	6	2
Medium	14	9
High	1	5
<u>Total</u>	<u>21</u>	<u>16</u>

It should be noted that this number of machine tools could be developed and designed in Brazil provided that something is done to strengthen the internal technological capability of the industry itself. Even so, dependence on foreign suppliers will remain high as regards design know-how.

Design know-how is imported through the purchase of designs with a once-only payment (a practice that is fairly common, although one that has not only legal and administrative problems, but also raises problems as regards the full and effective absorption of the know-how received), or through agreements combining the granting of licenses for the use of a particular design with the assistance required to translate the design into manufacturing instructions during the initial production period.

The legal provisions governing the acquisition of design know-how by the machine-tools industry would appear to be basically satisfactory. There are only two small problems worthy of mention.

The first is that all contracts and licensing agreements are limited initially to a maximum duration of five years, and are renewable for a further five years. This may be a problem with agreements covering know-how that is highly complex or that requires a comparatively long period of time to be absorbed. The second is that the 5 per cent ceiling set on the payment of royalties on patents may also be inadequate in certain cases - admittedly exceptional but all the more important for being so - when the know-how to be imported is highly complex and sophisticated. This is mainly attributable to the fact that all contracts are limited to an initial period of five years, which, given usual international practices as regards licensing agreements, has the effect of raising costs (to an extent inversely proportional to the length of the agreement).

A further problem is the reluctance of the Central Bank authorities to approve contractual provisions for fairly large initial payments a great deal in advance of the initiation of

/regular royalty

regular royalty payments. It is known, for example, that once a contract has been signed the seller hands over the documentation. If the technical know-how for a particular project is supplemented by know-how relating to internal technical standards, specifications for subcontracted services and parts and components acquired from other suppliers, the design of jigs, tools and other ancillary manufacturing equipment, and also know-how for establishing instruction cards and execution times, the amount of services covered by the documentation is considerable. Moreover, between receipt of the designs and the approval of the prototype one or two years may elapse, and it is only after this length of time that manufacture begins and royalties start to be remitted 20/. This is thus a problem that is related to administrative procedures, which, for very understandable reasons, are not always applied flexibly enough as it is not easy to establish objective criteria to guide official departments that are basically financial rather than technical in nature.

The principal problems relating to technological modernization derive from the fact that the machine-tools industry is dominated by small- and medium-scale enterprises with very limited technical capacity. These enterprises require special forms of assistance to enable them to:

- (a) Formulate their own needs correctly and properly;
- (b) Identify the enterprises abroad that can provide them with the know-how they need;
- (c) Negotiate agreements with foreign enterprises, as the local enterprises are sometimes incapable of mastering all the intricate provisions of such agreements;
- (d) Finance expenditure in respect of the remuneration provided for in agreements, in particular during the initial period when production is being set up with the new designs;
- (e) Absorb the know-how received in an efficient manner, as regards the day-to-day internal operations of the plant.

Important steps have been taken at the official level in this connexion. In addition to the expansion and strengthening of the Machine-Tools Institute associated with the Technological Research Institute of São Paulo, which is responsible for providing technical assistance on a continuing basis to the industry on specifically technological matters, mention should be made of the fact that programmes have been set in motion to reorganize industry in the state of São Paulo and at the federal

20/ ECLA, E/CN.12/920, op. cit.

level, in the first case through the Development Bank of the State of São Paulo and its network of productivity centres, and in the second through the National Bank for Economic Development, which is an executive organ of the Planning Ministry.

It is to be hoped that the practical effect of these steps, after the initial breaking-in period, will be to open up new and broader horizons for the transfer of technology from abroad through enterprise-to-enterprise contracts and agreements of the kind which at present are confined to the large enterprises in Brazil, particularly those in which foreign capital has an interest.

4. The planning capacity of the Brazilian engineering industries

The different categories of technical know-how considered in chapter II of the present document can be classified into two groups, which are essential for defining the strategy for an industrialization policy: project technology or technology relating to the ability to plan (products, processes, complete installations), and production technology or the ability to run a productive installation on the basis of given projects (designs, layouts, specifications for processes, etc.).

The first group is obviously more difficult to apply than the second, irrespective of the sector of industry considered, and it is much more difficult and time-consuming to disseminate within industry than know-how imported from abroad by means of agreements between enterprises. Production technology, on the other hand, lends itself more easily to being disseminated through imitation and other means that are independent of agreements with foreign enterprises.

Industrial development strategy based on import substitution made great use of the relative ease of disseminating production technology, which led to very rapid growth in the industrial sector but at a very high cost: namely, the accumulation in the industry of fairly low levels of know-how as regards planning capacity, which jeopardizes the future growth of the industries that in the countries are most subject to innovation.

It can thus be seen that the strengthening of national know-how in industry and the relations between this basic objective and the fundamental aim of expanding and consolidating the national scientific and technological apparatus are closely linked with the current situation and the future prospects of national planning

capacity. A study mentioned above examines this issue in the extensive field of the engineering and electro-mechanical industries 21/.

While it is not appropriate here to give a detailed account of the methodology used in the study, mention may be made of the specific aspects most directly related to the purposes of the present document. Suffice it to say that the study undertakes a comprehensive qualitative and quantitative examination of technological conditions in 19 sectors of the engineering and electro-mechanical industries, and looks individually and in great detail at 200 product lines or subdivisions of subsectors, 42 installations supplemented in different ways with imported material or equipment, and 22 process installations or simply specific processes, for a total of 264 different groups of products and processes. In each of these groups it analyses, and in some cases with certain limitations it also quantifies, the main aspects of technological development in each sector. After making a summary appraisal of the probable trend of technology in each sector at the world level, and a projection of demand for new products, improvements in existing products, etc. on the domestic market, it develops a frame of reference for comparative purposes which, when contrasted with the data on the current technological position of each sector and subsector, makes it possible to estimate, through a process of successive approximations based on orders of magnitude rather than on strict quantities, the amount of effort that the engineering industry will have to make to improve its level of know-how over the next ten years in order to conserve the position attained in the domestic market during the post-war period and to help to close the technological gap between it and its counterparts in the rest of the world 22/. The study also indicates a number of measures that are required to place the industry in a position to overcome existing obstacles and achieve its goals.

The situation in 1970 of the different branches of the industry as regards national planning capacity was examined in greater detail with respect to 186 subdivisions of subsectors or product lines belonging to 18 sub-branches of the electromechanical industry. The various branches of engineering and

21/ See Franco Vidossich, Areas estratégicas e desenvolvimento tecnológico nas indústrias eletro-mecânicas no Estado de São Paulo, op. cit.

22/ This study and the study on the machine-tools industry are probably the first attempts at technological forecasting made in Brazil. The method used may be considered a combination of intuition and 'pythonic' or 'delphic' techniques (see Erich Jantsch, Technological Forecasting in Perspective (Paris, 1967), chapter II, pp. 133-140).

electromechanical activities were classified by the origin of the know-how used to design the equipment used on the date of inquiry. The different levels of dependence on foreign know-how were classified into a number of categories which, for purposes of simplification, were reduced to three:

	Percentage of principal design aspects of equipment manufactured in the corresponding subsectors
(i) Product engineering of national origin	70 to 100 %
Product engineering of foreign origin	30 to 0 %
(ii) Product engineering of national origin	30 to 70 %
Product engineering of foreign origin	70 to 30 %
(iii) Product engineering of national origin	0 to 30 %
Product engineering of foreign origin	100 to 70 %

The situation in 1970 was manifestly unfavourable, as national design capacity was only dominant (i.e., produced the know-how for 70 to 100 per cent of the equipment or components considered) in 27 subsectors or product lines out of a total of 186: the equivalent of 15 per cent of the entire supply of product engineering in the engineering and electromechanical industries. In contrast, product engineering was predominantly of foreign origin (70 to 100 per cent) in 62 subsectors or product lines, representing 33 per cent of the supply of know-how for engineering and electromechanical projects.

The problem, however, is not so much the present situation as the need to raise national design capability to higher levels. The study notes that, if it is remembered that the national electromechanical industry has been in existence for barely a quarter of a century (1945-1970) and that it entered a developed world market whose origins date back to the pre-Napoleonic era, the overall results achieved are not out of line with what happened over the same period in the 1800's when know-how was transferred from one country or area to another: for example, from the United Kingdom to Sweden, United States, Belgium and the Netherlands; from France and the United Kingdom to Italy; from Germany to Poland and Czechoslovakia, etc. It is against this background that the figures in the tables should be viewed. From the historical standpoint, and at the current stage of world knowledge regarding electromechanics, the country would have found it difficult to give employment to 700 persons

/without remaining

without remaining dependent on others for project know-how. The study goes on to say that it considers that an acceptable amount of domestic planning capability has been built up in the industry over the past 25 years 23/. On this basis the study then estimates the probable trends of national planning capability in the 1970's and considers what has to be done to ensure that the projected trends become reality.

The figures given in table 18 as a hypothesis for 1980 show that, in order to gain a majority position, national engineering must move from its present level of 28 per cent of all cases to 51 per cent in 10 years or so. The great progress in engineering capacity anticipated in the 1970's in the State of São Paulo will not necessarily be equalled in succeeding decades. The 1970's, however, are crucial from the strategic standpoint. According to the study, everything would appear to indicate, on the basis of the broad range of the table covering 1970, that it will not be possible to make further progress or even to understand technical language from abroad until national engineering is involved in at least 50 per cent of projects. This seems a reasonable position as regards both the maintenance and the closing of the technology gap 24/.

23/ F. Vidossich, Áreas estratégicas e desenvolvimento tecnológico nas indústrias eletro-mecânicas no Estado de São Paulo, op. cit., pp. 262-263.

24/ Ibid., pp. 266-267.

Table 18

BRAZIL: ORIGIN OF PRODUCT ENGINEERING IN THE ENGINEERING
AND ELECTROMECHANICAL INDUSTRIES. SITUATION
IN 1970 AND ASSUMPTION FOR 1980

(Percentage share of the 186 subsectors
forming the 18 sectors listed)

Industrial sector using or producing equipment	Origin of product engineering					
	National: 70-100%		National: 30-70%		National: 0-30%	
	1970	1980	1970	1980	1970	1980
1. Extractive industries	-	29	42	71	58	0
2. Steel and semi-processed products	8	33	25	42	67	25
3. Heavy and semi-heavy boilermaking and similar	-	67	50	33	50	0
4. Machinery and appliances, including electrical	10	61	35	23	55	16
5. Shipbuilding	12	38	25	38	63	24
6. Aeronautics industry	66	78	12	-	22	22
7. Road transport	21	29	-	43	79	28
8. Rail transport	60	60	-	20	40	20
9. Roadmaking machines and similar	-	-	-	-	100	100
10. Electrical industry	10	33	14	38	76	29
11. Precision instrument and control and measuring equipment	-	0	55	20	45	80
12. Tools	20	46	10	27	70	27
13. Mechanical equipment for civil construction	-	0	44	44	56	56
14. Wood, pulp and paper industry	20	60	20	-	60	40
15. Office machines, calculat- ing machines and print- ing equipment	-	25	25	-	75	75
16. Textile industry	-	-	33	33	67	67
17. Machinery for agriculture and the food industry	13	13	33	53	64	34
18. Medical and hospital equipment	43	14	57	43	-	43
Total 18 sectors (percentages)	15	36	27	31	59	33
Number of subsectors	27	64	50	58	109	62

Source: Data taken from F. Vidossich, Áreas estratégicas e desenvolvimento tecnológico nas indústrias eletro-mecânicas no Estado de São Paulo, op.cit., pp. 260-261, tables 1 and 2.

It may now be asked what relationship can be established between the above points showing the scale of the technological leap forward that the engineering and electromechanical industry has to make in order to develop its own planning capability, and the probable trends of imports of foreign technology by means of enterprise-to-enterprise agreements in the 1970's. Unlike what might be thought at first sight, there will still be a need for a substantial foreign contribution of know-how, which will even have to be increased in the coming years in many sectors of the industry, thus partly offsetting the possible decrease in the contribution of know-how by other sectors which are either growing more slowly or apply stricter criteria to the approval of enterprise-to-enterprise agreements. This argument is reached 25/ on the basis of the study's conclusions on the increase in the variety of products (and consequently of product engineering) that is likely to take place in the 1970's. It examines the probable diversification of existing product lines between 1970 and 1980, and concludes that a gap exists not only as regards technology but also as regards the variety of products offered. In classifying the probable level of diversification in the 1970's on the basis of the situation in 1970, the study estimates that the level will be high in 118 (65 per cent) of the 106 product lines considered, average in 49 (27 per cent), and low in only 16 (9 per cent). It concludes that it is imminently likely, and essential for future growth in the industry, the domestic supply should be expanded by 1980 to include several lines of entirely new products as well as variations and improvements on existing products. It goes on to say that, unless the idea of increasing the variety of supply and introducing new lines takes hold now, the sector as a whole will be risking a technology crisis of major proportions 26/.

25/ The study in question is not explicitly concerned with this aspect of the issue, but the following comments it makes would appear to indicate that views on it coincide. Thus, the study states that it is essential to make it clear that the information and data it has compiled and processed would be of little service to the country if they were used to justify chauvinist measures for the electromechanical industry. In drawing attention to the impropriety of motives of this sort, the study reiterates the view that development strategy should be based on technical issues, for the development of nations is incompatible with outmoded and exclusivist views at the national level. (See F. Vidossich, Áreas estratégicas e desenvolvimento tecnológico nas indústrias eletro-mecânicas no Estado de São Paulo, op. cit., p. 258).

26/ F. Vidossich, Áreas estratégicas e desenvolvimento tecnológico nas indústrias eletro-mecânicas no Estado de São Paulo, op.cit., pp. 270-272.

The present document has not gone into the ideas in the study regarding the transport sector (aeronautics, modern shipbuilding and railway construction) as a growth-promoting agent in a new phase of technological expansion and improvement of the entire electromechanical industry, nor the components of a policy to support national scientific and technological bodies in their efforts to develop the industry, although these are principal aspects of the study. All that has been done here is to pick out the aspects that point up the need to continue to rely on a foreign contribution of know-how, through enterprise-to-enterprise agreement for importing technology and direct foreign investment with both agreements and investment being selected on the basis of sectoral criteria and complementarity with national industry. The final chapter of the present document will take up these issues again.

Chapter IX

TRANSFER OF TECHNOLOGY AND INDUSTRIAL POLICY

1. Introduction

The formulation of a policy for the transfer of foreign technology, as pointed out in different parts of the present study, and especially in the last two chapters, depends very closely on the parallel definition of an industrial policy and a technological development policy, or at least of their main elements.

Any analysis of such policies in all their multiple aspects is beyond the scope of the present study. It is, however, indispensable to analyse at least some of the main elements on which the approval of policy guidelines for the transfer of foreign technology depends most directly. In the following sections, therefore, only aspects of these policies which seem to be essentially related to the transfer of technology are analysed: the need for some basic definitions of sectoral industrial policy; the role of "technological forecasting" in the sectoral policy relating to certain sectors of strategic importance for the development of the economy; the possible use of regulations for the importation of technology in the development of the national production of technology, both in enterprises and in official and university technological institutes; and lastly, the dissemination of the technology transferred throughout national industry.

2. Industrial policy

No attempt will be made to enter into a broad-based analysis of the nature, aims and instruments of application of an industrial development policy; the discussion will centre only on some aspects most closely related with the topic of the transfer of technology. It will be remembered that in the course of the present study it has been maintained on several occasions that the formulation and systematic application of a policy for the transfer of technology, especially where the establishment of criteria for guiding the selection of the technology to be imported is concerned (i.e., the grants of patents and other similar items to be approved), only makes sense in terms of an industrial policy which has already been defined, or is about to be defined, parallel with such regulations for importing technology. The same observation was made regarding the frequently encountered proposal that a strategy for the export of manufactures should be designed in a more complete form, and that the criteria for selecting products or categories of products for export should be linked to a clearly-defined policy for importing technology, combined with a similar policy for national technological research. It was maintained that the

/convergence of

convergence of imports of technology, national research and exports of processed products (to mention only those aspects directly involved in the present study) should be based on, and take its point of departure from, the definition of some basic guidelines for an industrial policy, partly for the whole of industry, but mainly for each of the main manufacturing sectors.

(a) An industrial policy is made up of a group of instruments chosen to promote a set of aims within industry, closely compatible with the general aims of economic and social development. This could be understood as a reference to a clearly-defined industrial policy within an overall planning scheme, where the manufacturing sector would play the part of a sector of economic activity. Such an industrial policy would correspond to a group of industrial development aims established "from above", i.e., as part of an overall, conventional planning scheme, where the industrial goals and aims would derive from the overall rate of growth of the economy and the conversion of this growth rate into increases in sectoral demand, etc., following the usual procedures of overall planning.

In reality, however, no reference is intended to an industrial policy of this type, which needs to be defined on a very general plane. Conventional overall planning, not only in Brazil, but in practically all the developing countries, has come up against great difficulties of application. The approach which is making headway is that which consists of relegating to a secondary level - and to a second stage in the chronological succession of work - all the compatibility and consistency analyses on which this type of planning is based. These consistency analyses continue to be necessary, but they are increasingly regarded as something which should be introduced gradually through successive adjustments, so as to cut down the disadvantages of a more pragmatic planning system based on the preparation of sectoral programmes not closely linked (in their initial formulation) with a complete panorama of the behaviour of the economy acquired through the construction of models, but instead prepared "from below", i.e., through the aggregation of major projects and the formulation of goals and programmes both for new investments and for the reorganization and modernization of existing activities 1/. This topic was analysed

1/ In this connexion, see two recent papers by Albert Waterston, consultant to the International Bank for Reconstruction and Development, presented at the meeting of the Inter-American Development Bank held in June 1971: Technique-Oriented vs. Problem-Oriented Planning and Un enfoque operativo a la planificación del desarrollo (mimeographed). See also, by the same author, "Programação Setorial" in Planejamento e Integração Económica, Boletín de la Secretaría Técnica de la Presidencia del Consejo, Lisbon, July-October 1970.

in many of its aspects in chapters VII and VIII for a capital goods industry (machine-tool) and a consumer goods industry (textiles and clothing). The present chapter will only enumerate some main aspects of a sectoral industrial policy structured as already indicated, and will describe how this policy should provide a basis for a policy for the assimilation of technology.

(b) A sectoral industrial policy should include government definitions of the following main aspects, indicated schematically:

(i) An indicative formulation of growth targets for the private sector and the establishment of specific growth targets for the public sector, since both sectors sometimes coexist in the same branch of industry, e.g., the steel industry;

(ii) An estimate of the investments necessary in connexion with these goals during the whole period covered (not less than ten years for slow-growth investments and not less than five years in other cases), with an assessment of possible sources of finance, both domestic and foreign;

(iii) An assessment of the technological level of the industry (as regards products, production processes and equipment), from the dual aspects of a comparison of the industrial average with the technological situation predominating in the industrialized world, and an analysis of the spread of the individual enterprises with respect to this national technological average: i.e., the situation as regards the potential heterogeneity of the level of technology in the branch of industry under consideration, together with the formulation of some aims which should be achieved in this context;

(iv) An assessment of the scale of production capacity throughout the industry in comparison with the economic minima characteristic of the technology of the branch, and the establishment of minimum scales for new units of production or for the expansion of those already in existence, especially in the case of the industries with the highest capital-intensity

/per unit

per unit of value added, where the economies of scale are more pronounced 2/;

(v) An assessment of experience as regards exports by the branch of industry in question and an estimate of future possibilities, bearing in mind the probable evolution of external markets, and the expected evolution of national industry, in terms of increases in scales of production, modernization of products and processes, improvement of marketing methods, etc.;

(vi) Adjustment of the general economic policy, especially as regards the control of imports, to the growth aims fixed for industry; this, of course, implies that in the targets for the growth or diversification of industry, the level of protection necessary must be taken into account, not in a static sense, but within a reasonable time perspective, during which the effects produced may include reduction of costs, expansion of markets and scales of production, introduction of new production techniques and processes, gradual accumulation of external savings throughout the economy, with consequent effects on the branch of industry concerned, etc.

2/ This is one of the most negative aspects of current industrial policy (indeed, it is generally scarcely even implicit) in Latin America, even in Brazil, where awareness of the problem has emerged only recently (awareness is now clear in the steel industry but is still not obvious in sectors as important from the point of view of economies of scale as the aluminium industry, for example). In Spain and other European countries, the law, or simply administrative dispositions on the granting of licenses for new industrial activities, lays down minimum scales for the industries most sensitive to economies of scale, which are usually the most capital-intensive.

(c) Acquaintance with situations and the formulation of quantitative and qualitative aims deriving from an industrial policy consisting basically of the above-mentioned points 3/ would provide the basis, lacking today, for a better ordering of imports of technology and for the gradual formulation of a more complete strategy than that currently existing for the export of manufactures. The above-mentioned points, however, imply a very important element involving the need for an appreciable degree of "technological forecasting" as regards the probable evolution of the techniques, processes and products of the main branches of industry.

It is paradoxical that it is the developing countries, which play a practically insignificant role in world scientific and technological invention, which most urgently require to "forecast" - along general lines, of course, and with very broad approximations and margins of error - the future evolution of techniques (and also to a certain extent, trends in applied science). Technological forecasting is now widely used by government organizations in the industrialized countries and by the major enterprises which lead the way in technological know-how 4/. These bodies are in a privileged position as regards making use of this technological futurology. Even a country like Brazil, however, which possesses fairly advanced and diversified industry and is growing at an extremely rapid rate (according to present and past international models), cannot neglect the need to organize itself for the same type of exercise, for two main reasons or basic aims.

First, because the massive establishment of new branches of industry or the short-term renewal of large quantities of obsolete plant (programmes for the reorganization and modernization of industries such as the textile industry) underlines the need for "forecasting" the trend of the future evolution of technology. The industrialized countries, which established their industries a long time ago on a step-by-step basis, are able to carry out their technological modernization simply by replacing equipment and installations as they depreciate, over a broad time-spread. Thus, the risk of a sudden state of obsolescence throughout an industry is very small in relation to the risk run by the developing countries.

3/ The ECLA document constitutes an attempt to define the main outlines of an industrial policy in the context of Latin America.

4/ Erich Jantsch's study Technological Forecasting in Perspective, Paris, OECD, 1967, is already a classic in this connexion. See also the book edited by James R. Bright, Technological Forecasting for Industry and Government: Methods and Applications, New Jersey, 1968.

/In addition

In addition, this time-spread fragments investment decisions and thus diminishes the effect of modernization (which takes place through amortization) on the machinery and equipment industry. This could be another aspect of the problem of "indivisibility" affecting the growth of the new countries, and one which seems to have been ignored so far. Institutional treatment of this topic would seem justified, probably through official technological institutes or university departments of applied scientific development, within the appropriate sectoral specializations 5/.

Secondly, because the proposal to link imports of technology with the development of national scientific and technological production requires it. Thus, the establishment of a procedure for granting licenses to import technology, and the utilization of this procedure to assist the national scientific and technological system in providing services for industry, makes it indispensable to have available elements indicating the direction taken by technological development in the main branches of industry, and to provide criteria for deciding what technical know-how should be imported and what should be produced locally, from the point of view of national interests and possibilities. In considering this type of decision, it is interesting to bear in mind not only the effect on the efficiency of each branch of industry which specific alternative directions of technological development may have, but also the approximate social cost-benefit characteristics and the contribution of the various technological development alternatives to major aims of economic and social development, such as the export of manufactures. Other aspects should also be considered, e.g., the possibility of the gradual development of new relatively labour-intensive production techniques better suited to the proportions of the country's factors of production and the need to give employment annually to large contingents of labour 6/, the appropriateness of developing original

5/ In France, technological forecasting was used systematically in the preparation of the Fourth Plan; in Italy, the IRI uses procedures in this new field of knowledge to plan the development of the main industries belonging to enterprises under its financial control, and in the United States technological forecasting is becoming a matter of routine in many government departments.

6/ In this context, mention may be made of a recent document by Hugh Schwartz of IDB dealing with the need - and affirming the possibility - of pursuing research on the "development" of techniques more appropriate to the proportions of factors in the developing countries: Inducing Technological Change more compatible with Latin American Scarcities.

/processes and

processes and products, i.e. those incorporating important innovations, whether from the point of view of production costs or from the point of view of advantages for the consumer, in order to improve the export of manufactures and consolidate and make more permanent the flow of exports of manufactures, etc. Still in connexion with the export of manufactures, another important contribution which may be expected from technological forecasting concerns present international tendencies: the anticipation of intersectoral structural changes (and product changes within some sectors of industry) in the developed economies resulting from technological advances and giving rise to new opportunities for the developing countries to export highly labour-intensive products 7/.

Lastly remains to be mentioned the problem of linking up the new advances which it is hoped to produce in the national scientific and technological system, on the basis of the existing scientific and technological know-how and research and development institutions in the country. All these aspects, to which explicit or implicit attention should be given in the practical application of any reasonably effective industrial policy, require as a matter of course a systematic attempt at forecasting the major lines which applied science and technology will take in the main branches of industry.

It is easy to give examples of the ideas set out above. It is sufficient to mention the steel industry, which is the area in which Brazil happens just to have taken important measures to set up a sectoral planning system along the lines of that recommended above, and where institutional conditions and government policies capable for the first time of facing up to this type of problem are at last being set up. A reawakening of interest in the development of the Brazilian steel industry is taking place abroad, manifesting itself in the form of investments and imports, and, as may easily be understood in view of the exhaustion of mineral resources in places where they were traditionally abundant, industry in the developed countries is showing increased interest in the technological evolution of those activities which are most rapidly being transformed and show the greatest value added, to say nothing of the growing concern over the pollution caused by heavy industry. A rapid development of the Brazilian steel industry may therefore be expected, which

7/ The first Latin American country to do this was Mexico, through co-operation between the Nacional Financiera S.A. of Mexico (the main development promotion and official financing agency) and the Technical Assistance Administration of the United Nations. See the document, Promoción de exportaciones mexicanas de productos manufacturados, Mexico, 1967.

/will perhaps

will perhaps exceed considerably the target set in the recent national steel plan of 20 million tons of production in 1980. Meanwhile, the development of steel production in Brazil poses problems of the location of new investments, where "technological forecasting" may exercise a determining influence. Throughout the world there is a growing scarcity of metallurgical coke, which is used as a reducer in traditional blast furnaces, and according to studies of various origins, supply will not be sufficient to fulfil the demand anticipated in the next few decades. There is, however, a favourable factor in the possibility of developing processes which replace coke as a mere fuel, reduce the requirements for coke as a reducer per unit of final product, or replace metallurgical coke by some other element as a reducer (ordinary coal, natural gas or petroleum) 8/. These new processes are therefore at a premium, from the point of view of the future development of the steel industry in Brazil. In addition, the enormous importance of the new processes from the point of view of industrial location and internal economic occupation of the national territory is bound to increase still further. In fact, technological evolution in this direction could mean the channelling of new investments into a vast region of the interior of Brazil, in the heart of South America, where there exist abundant resources of iron ore and electrical energy (in this case still being developed), with a consequent change of immense social and political scope in schemes of industrial location and regional economic development. It may perhaps be considered that this example of the practical application of technological forecasting is too distant, from the point of view of practical application. This point will not be laboured, but it should be mentioned that this type of forecasting especially when it is in a branch of industry like the steel industry, where investment is characterized by a very long maturity period 9/, necessarily requires a very broad horizon of application, and moreover, in view of the ever-accelerating technological advance of the modern world, it must take numerous possibilities into consideration, even though they may not be converted into innovations whose economic viability is completely demonstrated. Experimental procedures, which may include implanting pilot factories, form an inseparable part of this technological "forecasting".

Another, much closer, example of the need for technological forecasting and its practical application which may be mentioned is explained in detail in one of the monographs which make up the present

8/ See in this connexion, United Nations, Interregional Symposium on the Application of Modern Technical Practices in the Iron and Steel Industries to Developing Countries, Prague and Geneva, November 1963.

9/ In many Latin American countries, this maturity period has been 7 to 10 years and it is difficult to find cases where it has been less than this lower limit.

series of studies on the transfer of technology in the industrial development of Brazil ^{10/}. This monograph demonstrated the need to know the main directions in which the different categories of technical know-how have evolved in the past and should continue to evolve in the future, within certain probability margins. The aim is to extract from this know-how elements that can assist in defining aspects where the modernization of industry can be expected - and promoted, though various government measures of support and stimulus - through the assimilation of technical know-how actually produced in the country, for example, in product design; and also aspects where this modernization will depend on a technological contribution (through grants of patents), or a contribution which is at once technological, entrepreneurial and financial (through direct investment) which would have to be obtained from abroad. In addition, an awareness of the probable evolution of the different techniques utilized in industry in the future by the most progressive world producers is essential for a realistic assessment of the absorption capacity of the national enterprises in each particular branch for each of the categories of modern technical know-how having recourse only to agreements for the use of products or processes (patented or not), independently of any capital association with enterprises established abroad.

(d) An industrial policy on the lines of the patterns defined above could be linked up with a policy for the assessment and selection of the transfer of foreign technology through an elastic process, preferably directed by the agency in charge of implementing the industrial policy. This process would involve applying an assessment system to the applications for licenses for importing technology, case by case, in the light of circumstances such as the following:

(i) Investment (new or expanded) would be adjusted to the current general rules applying to the sector as regards scales, etc. The main aspects of these principles have already been enumerated. In practice, this would mean the expansion of the powers of the Industrial Development Council (CDI) of the Ministry of Industry and Trade;

^{10/} ECLA, The transfer of technical know-how in the machine-tool industry in Brazil, op.cit. Reference may also be made to the study in the same series on the textile industry, The transfer of technical know-how in the textile and clothing industries in Brazil, op.cit., which discusses the need for a systematic analysis of technological evolution in the production and use of artificial fibres, from the point of view of the effects of innovations in this field on the production and use of natural fibres in the developing countries.

(ii) Applications for licenses presented simultaneously by several enterprises or groups of enterprises would be assessed to compare the different proposals from the point of view of the "logic" of importing the proposed technology within the existing structure of production or within a structure to be created in the future, in accordance with concrete plans formulated by each enterprise. The intentions announced by each applicant as regards research within the enterprise (or under contract in official or university technological institutes) for the adaptation, modification or replacement of the process or processes obtained through the granting of a patent would also be assessed, as would the technical and financial capacity of each applicant to put these intentions into effect. The terms of the contracts granted in each case by the foreign licensor, as regards the absence of restrictive clauses referring to export markets, levels of remuneration, etc., would also be taken into account.

(iii) The assessment briefly described in the last paragraph should be carried out in close relationship with the current sectoral programme for the branch of industry concerned, and it should be accompanied by suggestions from the organization making the assessments on the selection of alternative techniques and processes and the analysis of the proposed sites.

It would thus be possible to introduce gradually an element of selectivity in the approval of applications for the import of technology, not, however, in terms of abstract criteria, like the contribution to the value added or import substitution, but in terms of concrete aims for structuring the sector, like the size of the establishments, the ownership of enterprises (including the promotion of formulas of entrepreneurial and financial association between foreign firms and national entrepreneurs, or public or semi-private national enterprises), their regional location, their contribution to development through strong interdependence relations both "upstream" and "downstream", the creation of external economies for other initiatives, the contribution to a gradually defined and selective exports strategy and so forth.

3. The dissemination of industrial technology at the national level

It has already been pointed out in the first chapter of this study that the transfer of technology cannot be studied in the abstract, that is to say, without explicit reference to certain economic and social policy problems. In listing these problems, it was moreover suggested that the dissemination of technical know-how throughout the country was a fundamental aspect of any policy aimed at progressively reducing the differences in levels of development between and within individual states (as also between rural and urban areas). This applies equally to São Paulo, a state which boasts a remarkably high level of industrialization.

As in most other developing countries, Brazil's industrialization is characterized by widely varying levels of technology and operational efficiency among enterprises belonging to one and the same industrial sector. Hence the tensions and difficulties that have cropped up in the process of industrialization. From one enterprise to another, for instance, the value added per operator may vary by as much as 1 to 3, 1 to 4 and even 1 to 5 in the textile industry of Brazil and various other Latin American countries 11/, by 1 to 2 and 1 to 3 in the engineering industries 12/, and by even more in the paper manufacturing industry 13/. These variations reflect widely differing situations in terms of production processes and techniques, equipment and internal organization (including administrative and management methods), as well in the size of the enterprises.

It can be assumed that, because of the very nature of the innovative process in industry, there will always be substantial differences in the level of technology and productivity of enterprises within a given sector or engaged in the manufacture of a single product. What is more important is that this internal imbalance should be part of a forward-looking process in which the sector, on average, is making steady progress. This means that there must be two kinds of movement, each requiring its own economic policy measures. On the one hand it is necessary to promote improvements in technology and productivity at the upper levels through the incorporation of products and processes that are technically more advanced (in international terms). This is closely linked to the transfer of technical know-how from abroad and to a national scientific and technological policy designed to support certain "strategic" subsectors in each industrial branch. At the same time, however, a steady improvement must be encouraged in technology and productivity at the intermediate and lower

11/ See ECLA, The textile industry of Brazil (1963).

12/ See several ECLA studies on the engineering industries of Uruguay, Venezuela, Colombia and Ecuador prepared between 1962 and 1968.

13/ Leone Associates' report for the National Economic Development Bank of Brazil, op. cit.

levels of the same industrial branches, mainly by disseminating techniques which are more modern than those currently in use but which are already extensively employed in the more advanced local enterprises. This may be achieved through the provision of technical assistance for the transfer of technical know-how within the country by means of industrial extension services of various kinds offered by technological institutes and certain university departments concerned with applied science.

A widening of the efficiency and productivity ranges within one and the same industrial branch often coincides with the introduction, at a particular moment and for a limited period, of specific manufacturing methods of a higher technological standard which, because of their upward and downward relationships and, to a lesser extent, their demonstration effect, carry along other forms of production with them. This would seem to have occurred in Brazil on three particular occasions: after the Second World War in the engineering and electromechanical industries, following the expansion of production of machine tools and other series-produced industrial machinery during the war itself; from 1955-1956 onwards, when Brazil began manufacturing heavy equipment in small numbers and in single units at the start of the domestic industry's participation in the construction of the Duque de Caxias refinery; and, finally, during the rapid development of the motor-vehicle industry between 1955 and 1959. Today, Brazil is probably approaching a similar trend towards advanced technology in a sector of the engineering and electromechanical industry: namely, in the establishment of an aeronautical industry and the production of other goods which, by reason of the manufacturing and, above all, design techniques employed, are related to the transport equipment sector 14/.

It can thus be concluded that, unless the promotion of new and highly technological industries goes hand in hand with the application of far-reaching and deliberate domestic technical assistance and industrial extension measures by the various bodies comprising the country's scientific and technological establishment, the gaps in intrasectoral levels of productivity will become excessive. This would have the effect of accelerating the steady deterioration suffered by states at the earlier stages of industrialization and, possibly, of endangering the indispensable (albeit less intense) continuation of the process of modernization of the various subsectors of industry.

14/ See F. Vidossich, Áreas estratégicas e desenvolvimento nas indústrias eletro-mecânicas no Estado de São Paulo, op. cit., p. 122 et seq. and p. 271 et seq., on the importance of the transport equipment industries in the next stage in the technological development of Brazil's electromechanical industries.

How enterprises operating at such different costs can coexist in the same market under potentially or at least apparently competitive conditions is a question that it is difficult to answer altogether satisfactorily 15/. Certainly there are structural factors limiting and conditioning competition and deriving, possibly, from the general economic and social situation of the country 16/. This is why there has been a tendency for deliberate industrial policy measures to be introduced in order to make up for the lack of incentive for modernization and technological progress which direct competition should normally provide.

Steps to reduce progressively the relative technological imbalance to which IPEA refers (chapter VI, section 1) should operate in three different but mutually complementary directions.

In the first place, there is the problem of the transfer from abroad, and subsequent dissemination throughout industries and other economic sectors, of the mass of technological information not covered by patents, that is to say, relating to products and processes whose patents have recently become part of the public domain. These techniques and processes, which of course correspond to technology that has been superseded in the more advanced industrial circles where it originated and was at one time patented, may well represent more sophisticated know-how than that which currently exists in certain industrial branches and, in some cases, even in the most advanced enterprises. Such techniques have ample economic applications in the country's industrial sector, provided they are judiciously selected. There is an obstacle, however: namely, the lack of access of national industry to the external sources of know-how. The same obstacle arises in respect of techniques, processes, products and types of technical assistance for specific problems, even when the relevant technology is still protected by patents. In such cases, the signing of licence agreements with enterprises holding the patents is restricted by the shortage of information on other possible sources: a limitation which is particularly serious in the case of the smallest enterprises which

15/ The IPEA report Indústrias tradicionais: un reexame crítico (July 1969) sheds some interesting light on the subject.

16/ The circumstances in mind are, in particular, the relative isolation of the country's major regions from each other, owing to the tremendous size of the country and the marked unreliability of means of communication, the low level of general education of the mass of the population and lack of information (with the corresponding incapacity of consumers to buy selectivity), the absence of any climate of competition in industry and other economic activities as a result of the import substitution policy, and so on.

have less financial potential and less commercial and technological experience. The potentially available technological information 17/ - whether on know-how which has become public property in the industrialized countries or on that which is still under patent - should be incorporated in an external data collection system for subsequent dissemination inside the country. The federal authorities are currently considering creating just such a system.

Secondly, there is the problem of spreading the know-how acquired in Brazil's more advanced states (and notably in the South Central area) to the rest of the country. For this purpose, it would be useful to have a system for the transfer of technology and domestic technical assistance whereby the sum total of technical and scientific know-how, as well as personal experience, in every aspect of economic activity (though the industrial sector obviously offers more opportunities than any other) could be disseminated on a permanent and systematic basis, according to specific needs and concrete problems throughout the country. What is needed, therefore, is a national technical assistance system that would reproduce, at the national level, the philosophy and machinery (improved and corrected as far as possible and wherever necessary) of the international technical assistance system in both its bilateral and multilateral forms.

Proceeding from the general to the particular, it remains to examine the need for technology transfer machinery linked to the financial promotion instruments, at the internal level within each state, in order to meet such requirements as the development of the interior, industrial decentralization and, indirectly the decongestion of the major cities. Here, the example taken will be that of the

17/ Potentially available yet virtually unknown to the smaller and medium-size enterprise, which in many branches of activity means most of the industry.

state of São Paulo, since that is where the problem of developing the interior is becoming most acute and where the transfer of technology is an important aspect of policies involved 18/.

18/ São Paulo may seem a strange choice for demonstrating the nature of a process of dissemination of technical know-how in order to promote economic and social development, insofar as it is the state that is most advanced in terms both of technology and industry and of virtually every really important aspect of development: agricultural practices, scientific, educational and transport infrastructure, etc. It has been chosen intentionally, however, as it will show just how serious the problem must be in the other Brazilian states if it is already so acute in the most advanced state. Indeed, over the past twenty years the state of São Paulo has witnessed an extraordinary tendency (whose magnitude has perhaps been underestimated by most observers) for the population to concentrate in the capital and surrounding municipalities and has registered the highest levels of productivity and most rapid growth. The extent of the depopulation of the interior can be appreciated from the following figures taken from the latest censuses, which show the variations in the population of the regions in which the state's various municipalities are placed for administrative purposes and among which its 18 million inhabitants are distributed.

VARIATIONS IN POPULATION IN RELATION TO THE AVERAGE
VARIATION FOR THE STATE

(Percentages)

Regions of the state	1940-1950	1950-1960	1960-1970
Greater São Paulo	+64.0	+99.0	+96.0
Santos	0.0	+1.0	+4.0
Vale do Paraíba	-3.0	-6.0	-1.0
Sorocaba	-14.0	-12.0	-7.0
Campinas	-22.0	-10.0	-1.0
Ribeirão Preto	-24.0	-20.0	-14.0
Bauru	-20.0	-15.0	-14.0
São José do Rio Preto	-11.0	-6.0	-18.0
Araçatuba	+8.0	-9.0	-9.0
Presidente Prudente	+28.0	-6.0	-18.0
Marília	-6.0	-17.0	-18.0
Average variation for the state	+29.4	+42.0	+36.5

Source: Data supplied by the Co-ordinating Office for Regional Action, Economic and Planning Secretariat of the state of São Paulo. These data also seem to indicate an imperative need to promote development, along with its technological dissemination component, at the state level, too.

/A brief

A brief analysis will then be made of each of the three following aspects of the problem of dissemination of technological know-how: transfer from abroad of know-how not covered by licence agreements or other types of agreements between enterprises; dissemination within the country through a national technical assistance system administered by the federal authorities; and technological dissemination combined with the promotion of new industrial and agroindustrial activities in the interior of the state of São Paulo.

(a) A national system for the transfer of technological information from abroad

Several measures, now either at the planning stage or already partially applied, have been considered at the federal level in connexion with the organized and systematic transfer of applied, scientific and technological know-how from abroad. The most active bodies have been the National Research Council, the National Institute of Technology, and the National Institute of Industrial Property, the last two coming under the Ministry of Industry and Trade. In addition to these three major programmes, the National Iron and Steel Council (CONSIDER) is developing its own programme designed to follow developments in matters connected with iron and steel technology 19/.

The most immediately interesting programme from the point of view of industry is possibly that currently being implemented by the National Institute of Industrial Property. Its purpose is to compile and disseminate information on national and international patents, whether or not they are valid in Brazil and whether they have become public property or are still in effect.

19/ This information is based largely on the study carried out by Egberto Pereira, to whom thanks are due.

/This programme

This programme came into being when the treaty on co-operation on patents was adopted at the conference held in Washington in mid-1970. At this conference, Brazil introduced a number of additions and amendments to the original text that were intended to bring out the aspects most relevant to the developing countries 20/. Under the treaty, which has not yet been ratified by all the countries participating in the conference, an institutional structure is to be set up which, through international data collection centres located in the main regions of the world, will facilitate the acquisition of information both on patents that have become public property and on those that are still valid. The main task for which the National Institute of Industrial Property is trying to prepare itself, however, is the selection, classification and dissemination throughout the national industrial sector, - with at least a fair degree of efficiency - of the vast stock of information that will be compiled in this way. So tremendous is this task that it will need vast resources and a period of experimentation in order to be a success. The problem is too complicated to be considered in detail in this study; it must suffice here to draw attention to the need for permanent and effective communication channels which can put the national data collection and processing centre in touch with the users. The latter include on the one hand the enterprises themselves, which are the direct users, and, on the other, the technological institutes and state and university laboratories, as well as the individual research workers who serve as intermediaries in channelling the information to the industrial sector. Organizing and operating these communication channels on a permanent basis, without cluttering them up with an excessive volume of data and information with no practical application, is without doubt a short and medium term problem of considerable complexity, especially in view of the vast number of small and medium size enterprises in many branches of industry and the low technological level at which they frequently operate. Part of the solution to this problem may be found in the two following sections of this chapter, regarding the establishment of a national or inter-state technical assistance system and of a system designed to promote the industrial development of the interior of the state of São Paulo. Both systems should serve to disseminate technological data collected on a centralized basis through the centre set up by the National Institute of Industrial Property.

20/ Chapter III deals with this aspect in greater detail in connexion with the system of industrial property.

(b) A national system for the selection of technology and the provision of technical assistance

As a basic philosophy, the proposed national technical assistance system must, from the technological standpoint, contribute to the socio-economic integration of the entire territory of Brazil by creating machinery for the progressive transmission to the more economically backward regions of processes that have already been introduced (or devised) in the more economically dynamic industrial centres of the South Central region. The domestic transfer of technical resources under this federal system would be complementary to that already being carried out through entrepreneurial activities by means of investments in the SUDENE areas (and, more recently, in the SUDAM areas, too) for although the transfer of technical know-how in this way is extremely valuable, it is still inadequate. For instance, it does not serve existing enterprises or any others that local industrialists might establish in the Northern, Northeastern and West Central states independently of the system of incentives; under this system, they attract financial resources from the South Central states but receive no complementary technological assistance. Moreover, in addition to these enterprises, which are of small or medium size, there are a large number of other public, state or municipal initiatives in the various regions of the country where the co-operation of trained and experienced personnel from appropriate institutions in São Paulo, Guanabara, Minas Gerais, etc., could be of supreme usefulness.

Another point in favour of a policy of incentives for the domestic transfer of technical know-how is that it is a way of obtaining the best results from the total volume of resources available in the whole country. São Paulo and Brazil's other major industrial centres are at an intermediate technological stage between the requirements of the regions whose development needs to be intensified and the possibilities afforded by the industrialized countries. In other words, it is easier to adapt technologies that have been common currency in São Paulo over the past twenty years to the requirements of the North and Northeastern regions than to do the same with the processes and equipment that are in use in the industrialized countries. It must not be forgotten that the transfer of technology without adaptation can mean a serious waste of capital resources. Moreover, technicians and industrialists already operating in other parts of Brazil are bound to have a better understanding of local problems and activities than those whose experience has been acquired in regions of the world whose natural and institutional characteristics are completely different. In practice, comparability of technological levels and a knowledge of the environment and its particular problems can contribute greatly towards a more economic use of available resources.

/The organization

The organization of an inter-state technical assistance system would of course be the responsibility of the Ministry of Planning and General Co-ordination, in close liaison with the Ministry of Industry and Trade and other ministries. In the states themselves, the appropriate economic and planning secretariats could be used for the actual implementation. This organization, which basically would attempt to reproduce at the domestic level (in a suitably adapted form) the technical assistance system of the United Nations, would incorporate the following major concepts, which are listed more to illustrate a central idea than in order to provide a detailed description:

(i) Requirements to be met. The public and private bodies of states at an early stage of development would address their requests for technical assistance to the Agency (i.e., the body responsible for the technical assistance programme, whether attached to the Ministry of Planning or subordinate to it) through other agencies (these would vary according to the institutional set-up of each state - Planning Secretariat, Development Council, State Development Banks, and so on - but only one agency would be designated for the purpose in each state). Requests would be made out on pre-established forms indicating the nature of the technical work to be undertaken, an estimate of the time needed to carry it out, the body responsible for local collaboration with the expert or experts, and the technical and economic objective sought. The technical departments of the Agency would then revise and correct the requests where necessary, possibly deciding, in certain cases, to send out officials or consultants to make a better assessment and definition of the requirements to be met. Finally, the Agency would prepare a description of technical functions, their duration, etc., and estimate the cost of the mission. This description would follow a standard model and would be circulated among the public or private agencies in the economically most advanced states where the necessary experts would be recruited.

(ii) Priorities among the requirements to be met. Technical assistance would be provided in accordance with priorities established under a ten-year economic and social development plan and complemented, inasmuch detail as possible, by the priorities set by the state or regional development bodies. These priorities should naturally take into account the requirements, specific plans of action and particular circumstances of each state. They would be periodically reviewed in the light of new circumstances and of the experience acquired in the execution of the plan.

(iii) Recruitment of experts. The Agency should employ a minimum of permanent experts, recruiting almost all the personnel sent on technical assistance missions on a temporary basis from the staffs of state technical departments, technological institutes, university departments, private consultant firms and private industrial enterprises. It could also contract directly the specialized services of private consultant, survey and project enterprises.

/(iv) Remuneration

(iv) Remuneration of experts and financing of the system. The Agency would recruit experts on a temporary basis under pre-established standard conditions taking into account the nature of the mission, its duration (days, weeks or months), the age, studies and experience of the expert, etc., and would then send them to the various states to provide the assistance requested. The services of consultant firms would be contracted under the prevailing conditions for this type of work. The remuneration of the experts would be in two parts: basic salary, and daily allowance or per diem. The basic salary would be paid by the Agency, but the per diem would be paid by the state body requesting the technical assistance. Both types of remuneration would conform to uniform standards according to the category of the expert, the region to which he was sent, and so on. As regards the payment of the basic salary, two options would be open to the Agency: either the bodies employing the experts could lend them for the purposes of the mission, continuing to pay them their salaries as a form of collaboration with the technical assistance programme, or else the Agency could use its own funds where such collaboration was not forthcoming or was inappropriate.

(v) Responsibility for supervision of the technical missions. Under the United Nations technical assistance system, the experts - as far as the execution of their mission is concerned - are responsible to the local body to which they are seconded and submit their reports and conclusions directly to it without any intervention by the central agency, which merely receives a copy of the report on the mission. In the case of Brazil, this system would probably have to be modified since many states requesting assistance would not be equipped for the task of supervision; the experts would thus remain responsible to the Agency, in some cases even during the actual execution of the work. This would most likely be the case with missions consisting of more than one expert, organized in order to define and prepare specific investment projects to be financed by the BNDE or other federal bodies.

(c) Contribution of regional and state development activities.

Another aspect of economic and social development in which the transfer of technology plays a vital role is the promotion of decentralization at the state level. Let us take for example the state of São Paulo.

In promoting the industrial development of the interior of the state through the creation of small industries utilizing local raw materials and preferably supplying the relatively limited subregional markets, three major tasks will be involved:

- (i) determination of specific opportunities;
- (ii) adequate formulation of relevant development projects for submission to the financing agencies;

/(iii) financing,

(iii) financing, not so much from the standpoint of the overall availability of resources as in the sense of rapid and efficient contact between the users and the financing agencies located in the state capital and in Rio (BNDE).

(i) With regard to the first point, the solution is hardly likely to be found in any study showing the branches or types of industrial activity which are most suitable for development through small industries or which require less investment per unit of product (and of manpower), for such a study would necessarily have to be so general in nature as to have no practical application. This has been demonstrated by several attempts along such lines and in numerous discussions of the subject in international meetings and conferences. The tremendous variety of industrial activities and the need to adopt known or traditional processes to the special characteristics of the local raw materials (agricultural products, construction materials certain mineral products) militate against the application of a general solution formulated independently of an analysis of each case. Such an analysis would require top-quality technological skills which would obviously not be available within the state and could not justify the creation of technological centres specifically designed for the purpose in each subregion of the state. Advanced technological know-how is required even (or perhaps especially) in order to come up with relatively uncomplicated solutions or to resolve minor technological problems.

Further emphasis on the need for high-level technological backing is provided by the opportunities for development of areas which are backward, have limited markets or possess fairly uncommon raw materials that are afforded by the "breaks" that frequently occur in technological development. These opportunities can only be seized by units that are up to date with the latest technical advances in the relevant fields, including those that are becoming less and less specialized in view of the increasing interrelation between different branches of technology and the possibility of opening up industrial horizons in a particular sector as a result of the application of innovations or basic principles evolved in some totally different sector.

It is suggested, then, that this advanced technological contribution to the determination of industrial opportunities should be achieved through the institutionalization of technological collaboration between elements of the Technological Research Institute (IPT) and other similar centres with a view to the development of the subregions of the interior. This could be brought about by the close permanent collaboration of these elements within a network of subregional promotion and development centres (Productivity Centres of BADESP or their equivalent) that would combine a knowledge of local conditions with the technological knowledge of products and processes from which the determination of opportunities would derive. More systematic research into these opportunities (particularly from the economic stand-point) would be conducted by economists based on the

/centres and

centres and working in co-operation with local economic entities. Their collaboration would moreover help facilitate the subsequent mobilization of local entrepreneurial elements.

(ii) It can hardly be expected that local entrepreneurs would always themselves be prepared to formulate projects determined in the manner described above. These projects would therefore be indispensable both as a means of submitting the requests for financing and for "pedagogical" purposes, in the sense that they would serve to train local entrepreneurs in the correct assessment of new enterprises and the expansion of existing enterprises. They could be prepared by local consultants or by consultants from the nearest large city or even the state capital, partially assisted or supervised by the productivity centres or the nearest local development agencies. Thus, this system, while eliminating a major obstacle to the establishment of new industrial enterprises in the interior, greater experience in project designing and in the provision of advisory services to enterprises in general to settle there. This could be a highly significant factor in the subsequent development of other initiatives in sectors other than industry.

(iii) Finally, there is the problem of financing, which derives not so much from any shortage of industrial credit on soft terms (given the existence of the Fund for financing small- and medium-size enterprises (FIPEME) and other funds) as from the difficulties that arise over contracts between development financing agencies, inevitably located in the state capital, and the possible users. For obvious reasons, it is out of the question to establish a network of agents of the financing agencies or to use the private or state bank networks. Furthermore, it would be advisable from every point of view to devise mechanisms for tapping local savings, thus retaining them in the place where they were created and using them for financing new enterprises in the interior. Both these objectives - the geographical extension of the state development bank's sphere of action and the mobilization of local savings - could be attained by creating, or rather by providing the incentive for local elements to create, bodies similar to local development corporations covering state subregions of a certain minimum size, with capital coming for the most part from local sources and, for the rest, from the state development bank, the local savings being tapped in the form of time deposits, sale of shares in local financed enterprises, etc., and guaranteed by BADESP. In this way, the region would be encouraged in its own initiatives, and the human resources of the interior itself would be utilized as far as possible - and increasingly as time went by, even if it were necessary at first to employ outside elements in certain subregions. Only through such a system which has been successfully applied in Venezuela, Colombia, India, etc., and which is favourably looked upon by the International Finance Corporation (which is in a position to contribute capital resources in the form of securities and loans, provided most of the capital comes from private sources), would it be possible to acquire the intimate knowledge of local conditions that is necessary for the large-scale and successful development of the interior.

The three kinds of programme to which reference has been made - transfer of external technology, dissemination throughout the country, and "industrial extension" for combined application with financing programmes at the state level - are all links in a single chain, and the extent of their effectiveness will depend upon their being conceived and applied with that in mind. The corresponding elements, however, would have to consist, from the technical and administrative standpoint, of separate and independent parts operating in close co-ordination - though with a minimum of centralization - and incorporating as far as possible various partial initiatives already under way.

Within a system such as that described here, there is every reason to expect effective results from an entity devoted specifically to organizing the importation of technological know-how. As has been pointed out, this entity should not engage exclusively, or even predominantly, in the transfer of technology from abroad; on the contrary it should see the transfer of technology as an integral part of sectoral industrial policies, fitting into a planned system of dissemination of technical know-how and operating at the various levels to which reference has been made.

