United Nations

Economic Commission
for Latin America

Buenos Aires Office

Inter-American
Development Bank

IBD/ECLA Research Programme
in Science and Technology

Working Paper N° 3

COMPETITION, OLIGOPOLY AND TECHNOLOGICAL CHANGE IN THE CONSTRUCTION INDUSTRY

THE ARGENTINE CASE

Guillermo Vitelli

Distr.
RESTRICTED
BID/CEPAL/BA/38
October, 1978
ORIGINAL: SPANISH

780903

Oficina de la CEPAL en Buenos Aires
Cerrito 264, 5° Piso
1010 Buenos Aires, Argentina

CONTENTS

INTRODUCTION

A review of a large part of the economic literature produced in this country reveals that it is difficult to find any material giving an overall analysis of the construction sector. It is generally treated cursorily, and as an example of a technologically backward branch, or of a sector which, because it is labour intensive, characteristically reduces the pressures arising from an increase in overall unemployment. Stereotypes accepted without question are more common than studies which allow them to be corroborated or not in practice. At times we are inclined to think that there is an almost universal acceptance of the idea that construction is a self-explanatory sector. But it is surprising that, in spite of a vast number of limited studies and publications 1/ there is no overall systematic study. It is difficult to proffer any explanation, especially if we consider its relative importance within the economic structure or the fact that its products - so to speak - are elements which in fact "touch" us every day.

This lack of overall studies, especially from a clearly economic point of view, has left substantial questions unanswered, which, as we see it, has emphasised even more the pseudo-validity of so many commonplaces. Without going too far into the possible reason for this, we could venture to suppose that the diversity of products which go to make up this branch - and which range from an individual dwelling to a large dam - makes understanding of the market structure and therefore of company behavior more complex.

The large number of construction firms in existence may lead us to think, for example - still working on an intuition - that the extent of firm-concentration in the supply of construction services is low. Nevertheless, if we divide up overall supply into limited sub-markets, it is feasible that we will find such different structures that they will require individual study for us to obtain greater knowledge of price formation and capital accumulation at the micro-economic level. This division may or may not also lead to a confirmation of another of the traditional stereotypes; that of the low incidence of firms backed by foreign capital. Any overall analysis will naturally hide the peculiarities of each sub-market; and the importance of firms according to the origin of their capital is, in particular,

---

1/ Throughout this paper we shall give details of a large amount of this material. But perhaps the most significant fact is the widespread dissemination of information which, because of its nature, is in other branches kept absolutely secret: several specialized magazines (belonging both to business organizations and to the different research institutions) constantly publish extensive details of construction being carried out, giving information, for example, about the nature of the construction firms, the origin of the technology and in many cases about license agreements. The same happens when new materials or equipment are launched on the market. It is probably one of the sectors where economic information is least concealed.

one of the features which may remain concealed. Although it may seem paradoxical, it is probable that this division may allow us, in fact, to understand a large proportion of the overall phenomena. If it were to show us different market structures and also different degrees of participation of foreign capital, it would be valid to think that within this branch several kinds of entry barrers may exist, to entry which may have a specific influence on each kind of project. What is more, we may consider that building firms have not always had to internalize the same advantages in order to achieve a dominant position in each sub-market. Thus it is natural that the different supply structures may lead us to investigate the nature of firms and in particular the relative advantages of the larger ones; or the features which allow them to increase their share in the market or not.

There is a general idea that firms with a higher growth rate (and in some cases greater market stability) are those which have been able to achieve links with different financial channels. To a large extent this idea rules out other kinds of advantages which can arise from the construction firms ability to develop - or encourage - their own technological capacity. Perhaps the relevant discussion concerns the influence each of these advantages has on the firms' performance, since in some cases it may be the financial variable which is more important, while in others it is the ability to create new technologies. If we deepen our analysis a little more, it may be relevant to ask also about the origin of techniques. If again we take as our basis an a priori idea which describes the sector as an assembly branch or prefabricated parts assembly we might consider that new technologies normally come from developments outside the sector, the construction firms playing a passive role as simple " absorbers" of techniques or new products, created, in particular, in the manufacturins branches. However, it is likely that, if we go into greater detail into the nature of an assembly industry, we shall find situations so different that we shall be led to reject this initial image.

Perhaps each one of the stereotypes which we have accepted as natural characteristics of the sector may be superficially pointing out to use the kind of areas - or more precisely, variables - which we must consider in an overall analysis. It is possible that by questioning them we may be led not only to study the market structure or the importance of the firms backed by foreign capital, but that we will also be led to investigate a more important point: the entrepreneurial behavior. Or more precisely, the elements which determine the present position and size of the construction firms. Logically a study of behavior implies the need to analyze subjects like barriers to entry (or to growth) facing building companies, and to give much greater emphasis to technological behavior. It is feasible that there may be many reasons behind it. But perhaps one of the most important arises from the very possibility the sector offers us of understanding the response of local firms - given their large number - to an overall process which many authors have described as of increasing foreign takeover both in terms of the penetration of foreign capital companies, and of the more and more marked use of foreign technologies.

Our paper attempts to describe a large number of the variables which have traditionally been employed to study all sectors of economic activity. It is likely that there are substantial topics still to be developed, although our initial intention was to sketch an overall analysis of the sector with the perhaps over-ambitious aim of removing the myths surrounding so many commonplaces. 2/

Many friends supported me in this task. Especially Jorge Katz and Ricardo Cibotti, the directors of the BID/ECLA Programme, who were a permanent and ungrudging source of great intellectual stimulus. Without their help it would have been difficult to carry out a large part of the work. I am also grateful to Daniel Chudnovsky who constantly encouraged me, particularly during the first stage. In addition, I wish to thank Juan Sourrouille and Bernardo Kosacoff, whose great generosity is a further incentive to carry on with research.

I also owe an enormous debt of gratitude to the members of the Program, who have undoubtedly created a stimulating atmosphere for intellectual discussion. I extend my thanks to Simon Guerberoff, and also to Norberto Soares, who patiently checked the whole paper and thereby made his own very positive contribution to it.

I am further much indebted to Ana Furlani de Sabelli and Jimena Sena de Licciardi, who had the task of deciphering my impossible manuscripts.

It remains for me to thank my wife, who was not only a constant source of encouragement, but also assisted me in the tedious compilation of statistics.

Guillermo Vitelli.

Buenos Aires, December 1976.

2/ We have divided our paper into three parts: in the first we try to describe the behavior and structure of supply; in the second the process of technological change; while in the third we study the sectors which supply materials and equipment. In this preliminare version we present only the first two parts.

PART I

THE CONSTRUCTION INDUSTRY

Chapter I. General Characteristics of the Industry

The start of a research project designed to study one sector of economic activity presents, with rare exceptions, the problem of defining the universe to be covered since there are situations where, at their limits, a number of activities common to several branches converge. Any definition which makes a sharp distinction is obviously to some degree arbitrary. But although all classifications presently employed are relatively open to criticism, it is possible that, without substantially altering the criteria on which they are based, the groupings can be reformulated, thus modifying the limits of each industry, and therefore, the theoretical markets they define.

If we take the classification used by statistical bodies to define the construction industry, we observe that it includes within the same universe branches which manufacture completely dissimilar products by different technical processes. 3/

3/ In the definition of the universe of the construction industry are included all those activities which appear in section 5 of the SIIC Classification (Standard International Industrial Classification), defined by the United Nations and accepted by the Instituto Nacional de Estadística y Censos as the basic instrument for classifying the various domestic economic activities. Section 5 "includes erection, repair and demolition of buildings, highways, streets; basic construction works, such as drains and waterpipes, railway embankments, railway lines, unloading bays, tunnels, underground railways, flyovers, bridges, viaducts, dams, drainage and sanitation works, aqueducts, irrigation and flood control, hydroelectric power stations, hydraulic plants, gas and oil pipes and other kinds of basic constructions; maritime works such us dragging, removal of underwater rocks and installation of piles, land improvement, port and canal construction; well drilling; airports; sports fields, golf courses, tennis courts and other sports areas, swiming pools; parking areas; communications systems such as telephone and telegraphic lines, and all other kinds of construction carried out by private companies or public authorities. Also included in this section are skilled construction industry contract workers such as carpenters, plumbers, plasteners and electricians On the other hand, not included are erection repair and demolition works carried out incidentally by the personnel of a firm for its own purposes, if such a firm appears in another economic section. For example, when excavation, waste disposal, opening up of wells or galleries and dragging are carried out as part of mining activities, they are classified in the section relating to "mine and quarry operations". Taken from Banco Central,

This grouping is apparently made from a purely engineering point of view with the aim of bringing together all those activities which make up fixed gross domestic investment, except for that involved in equipment and machinery.

Despite the fact that all general information is based on this criterion, we have decided to modify the sector's limits for the purposes of our research taking as the group criterion all those activities which, included in the SIIC nomenclature, are or can be, carried out, by the same construction firm. Of course, we are not unaware of the fact that in the choice of our universe there is a relative degree of arbitrariness, but we are attempting to shape a theoretical market, made up of all those activities which the same firm can undertake on the basis of its technical substitution capacity. 4/

Accepting a priori this kind of classification and perhaps the errors too, in this chapter we shall attempt to define the basic characteristics of the sector, chiefly emphasising those which are peculiar to and determine the overall construction services market. In order to do this, we shall analyze the dominant features of supply and demand, relating to both public and private building. That is, we shall draw the first dividing line on the basis of the origin of funds, with the objective of describing the essential features which differentiate the construction sector from or make it similar to the other industrial sector.

Sector Characteristics

The first element found to be a dominant feature is the origin of demand: it would not be an exaggeration to affirm that perhaps there is no other branch of industry in which the division and juxtaposition of roles between demand from

---

Sistema de Cuentas del Producto e Ingreso de la Argentina. Metodología y Fuentes. Vol. I, 1975, p. 59. In the form drawn up by INDEC for the National Economic Census in 1973, building contractors were those general contractors who worked on the demolition, erection, alteration, repair and preservation of buildings and other constructions; those contractors were added who specialized in carrying out certain stages of construction, such as concreting, electrical installation, excavation, painting, glass installation, sanitary installation, etc.

4/ In practice we have excluded from the SIIC classification "maritime works, such as dragging and removal of underwater rocks, construction of telephone and telegraphic lines and well drilling". It is likely that there are some firms which in the course of carrying out sanitation or electromechanical construction works also carry out this kind of work since they can use substitute equipment, but because of the nature of the information available to us, we considered it better to leave them out and carry out the study on the reminder only.

the public sector and that coming from private enterprise are so clearly defined.

If we divide up the market in 1974, we see that approximately 40% of the gross value of production came from public works. If this information, which covers all the construction works included in the SIIC classification is broken down, it reveals the heterogene ous nature of theproducts which make up the industry as a whole. 5/

	Share of each kind of construction work in the gross value of production in the construction industry. 1974.	
Construction Industry	100%	
Private Construction Works	59, 1%	
Housing Construction		43, 2%
Industrial and Commercial Buildings		13, 0%
Other Private Building		2, 9%
Public Works	40, 9%	
Roads		8, 2%
Hydraulic and Electrical		9, 0%
Other Public Works		23, 7%

Source : Banco Central de la República Argentina

5/ It must be borne in mind that each one of the kinds of construction works which make up the next table in turn group, together a number of construction activities which are related but relatively dissimilar in nature. Roadworks, for example, include activities ranging fromurban paving to complex highway systems. The same differences appear in the other areas.

In general, the average volumes per unit of construction are significantly higher for construction work contracted by the public sector, since in the private sector - because of the very nature of building construction - demand tends to be broken down into small individual units. This leads logically to technical demands which correspond directly to minimum work volumes and which, together with the special characteristics of each building, lead to the formation of an industry divided into clearly differentiated submarkets, in which the requirements with regard to company organization, equipment and labour endowment demanded by each one are equally dissimilar.

But despite this apparent heterogeneity, there are, of course, common elements. One of them is the geographic location of demand, since each construction must be sited in the place requested by the proprietors 6/ This is the cause of the large number of different work sites (in fact there are as many as there are construction works going on) which influences the productive structure of the sector. Supply must therefore be adapted to a fragmented market situated in specific places, which brings about, in cases in which it is difficult to take advantage of scale economies, the formation of a high number of firms to satisfy demand. 7/ Theoretically, each construction can be carried out by a different firm, given that it requires a specific kind of company organization or technical group for its execution. Different authors have demonstrated that it is rare for a company to achieve unit cost reductions by increasing the number of works being carried out at the same time. 8/ More precisely: it is difficult to achieve scale economics which allow the formation of large firms.

6/ Andrés Imaz Sanz; Estructura de la Industria de la Construcción en Información Comercial Española, Madrid, August, 1965, p. 52.

7/ By our definition, scale economies occur when increases in production lead to reductions in the unit cost of each good. The subject of scale economies will be studied more fully in Chapter IV, in which we shall demonstrate their irrelevance to the housing construction sub-markets and to the sanitation and electromechanical (street lighting) sub-markets. In this connection see also Peter J. Cassimatis; Economics of the Construction Industry, Studies in Business Economies N° 111, NICB, U.S.A., Chap. 4, in which he postulates that the only sub-market in which there are potential scale economies is in housing construction a point which we shall also analyze in the following chapters.

8/ See Peter J. Cassimatis op. cit. pp. 58 and 67; P.A. Stone, Building Economy, Pergamon Press, 1966, pp. 90 and ff; Antonio R. Lanusse, "Construcción Industrializada Aplicada a la Construcción de Viviendas Económicas". Rev. Construcciones N° 231 (Sept. - Oct. 1971) Buenos Aires, pp. 589, 590 and 591.

This brings about the formation of a significantly fragmented supply, which corresponds to a certain extent to the fragmentation of demand.

If we accept that the number of companies equipped to carry out several construction works at the same time is in general relatively small, it is easy to conclude that there is a direct relation between the number of projects and number of building companies involved in the market. 9/ Without ignoring the importance of the qualitative differences of each construction, that is their volume and technical nature, that relation proves that in the face of fluctuations in demand, an adjustment in the number of firms may take place without the fragmentation of firms being destroyed; that is, supply is influenced both by the number of construction works on the market and by the specific characteristics of the way the product is made, which rarely allow scale economies.

9/ This point also corresponds to some extent with the degree of specialization of the companies. In general terms, the construction firms which have the highest annual turnover undertake simultaneously constructions of different kinds; on the other hand, firms with a lower relative turnover in most cases are involved in a specific sub-market. The execution of different types of construction (roadworks, industrial, electromechanical) demands from firms a significantly higher level of equipment, which limits the number of firms able to commit themselves to different kinds of work. In this respect, if by our definition a firm in the construction area has a higher level of specialization when it is exclusively involved in a specific branch, it can be stated that there is an inverse relation between the degree of specialization and the size of firm. Only in certain cases do the larger firms restrict themselves to one specific kind of construction, which would allow us to assert that they show a relative level of specialization. But if we analyze their perfonmance over an extended period of time, we see that they have undertaken works of a different kind from that of their apparent specialization. On the other hand, companies with a limited volume of work are permanently involved in one single kind of building, which prevents them in critical times for their sector, from undertaking different kinds of works. In this respect, specialization is a consequence of the low level of technical and financial capacity of each firm, and not the other way around, as can be seen in other areas of economic activity. Here, diversification often tends to load to the formation of groups, although each separate establishment may tend to specialize individually within the limits defined by its technical and organizational structure.

To a great extent the very geographic location of demand shapes a mobile-centred industry, in which each construction site is organized on a system of workshops actually installed on the sites, so that the basic feature of the equipment employed must be that it can be adapted with relative ease to new mountings and assemblies, which are carried out in most cases with different combinations of similar equipment. 10/ These workshops function like industrial plants, and since they differ significantly for each kind of construction, this demands of the construction firms a company organization of a kind that will allow some degree of geographic mobility and constant adjustment to new technical demands which arise from the manufacture of individual products. That is, a construction firm must constantly adjust the composition of its fixed capital as the only way of absorbing this kind of changing demand. 11/

Such characteristics influence the incorporation of technology, since they require the equipment used to be adaptable to new combinations of machinery, and easily transportable, in order to satisfy a geographically localized demand. This restriction has relatively less weight in almost all the other sectors which make up manufacturing industry, since the very essence of manufacturing processes is based on a criterion of a fixed site for plants.

On the other hand, three clearly differentiated agents normally participate in the planning and execution of a construction work: first of all, the planners or technical departments which draw up the overall plan; secondly, the owners of capital or the finance companies; and finally, the construction firms themselves. Due to the characteristics of the work process, these three agents are involved only temporarily in the planning and execution of a project, and may be legally independent entities. In other sectors, basically in manufacturing industry, it may be a necessary condition for growth of production that these agents form a permanent part of the same firm. This is what happens in a large number of industrial firms which have an engineering or product department as an integral part of their structure and forming an important link in the productive process. On the other hand, in the construction sector this kind of integration is observed in a limited number of firms, due to the fact that only one part of the building process demands it. The construction of works of a similar nature

---

10/ Andrés Imaz Sanz, op. cit, p. 52.

11/ Generally, construction firms operate with a level of their own capital significantly lower than their volume of turnover. Calculations by the Cámara Argentina de la Construcción show that this ratio is approximately 1 to 10. Informaciones, December 1974; Cámara Argentina de la Construcción. Buenos Aires. See also Bases para una Política Nacional de Vivienda; CFI., Buenos Aires, 1964.

and dimensions may involve firms in which those agents are part of their permanent structure, or firms in which this link-up is only temporary. This does not mean that the latter are unable to share in the market but logically there exists a direct relation between the degree of integration and the size of a firm, and its ability to capture larger volumes of work.

Because of this peculiarity, then, firms are able to share in the market without needing to maintain a permanent staff, since the building process in several sub-markets determines different personnel requirements according to each stage of the construction, thus leading to subcontracting of parts or stages. The reasons for this must lie in the fact that most firms, especially those involved in housing construction, do not have sufficient technical and professional capacity to carry out all stages of a construction work. To cover this they habitually resort to subcontracting. This partial delegation of tasks to subcontractors independent of the main firm demands a special level of organization, since it requires the assembly and coordination of different isolated economic agents who may have conflicting interests. In this sense, several firms contribute simultaneously to the making of a product, which sets them apart from the firms operating in manufacturing industry.

The characteristics we have so far observed essentially determine the formation of a fragmented supply structure which in the market must face a different demand for each kind of construction. The demand for roadworks, for energy plants, and even drainage works is highly concentrated. On the other hand, demand for housing construction is relatively fragmented, although it has different structures according to the origin of the client. It is logically more concentrated when the plan emanates from public entities, who usually carry out multiple constructions.

This concentrated nature of the demand for public works affects the development of construction firms, since the lack of continuity in public investment programs is inevitably reflected in the degree of idle capacity in the firms, which to some extent prevents them from developing integrated company organizations with the aim of achieving a greater ability to move in and out of the market.

So far we have analyzed, in general terms, some of the characteristics which define the supply and demand structure, but without considering the kinds of contracting which appear in the market. Three different characteristics can be observed, which depend on the origin of the client. When the demand comes from the private sector, contracting takes the form of a traditional transaction: a work contract is usually drawn up and the contractor chosen through relatively direct contact. 12/ On the other hand, when the client is a public entity, the mode of con-

---

12/ The private client carries out, so to speak, a private tender by seeking a lower price, but enters a less straightforward market because information is imperfect.

tracting differs significantly. There is a public tender and the client must comply with a number of technical and economic requirements which define his capacity to contract.

All this is regulated by the rules for registration of construction firms with Public Registers, since every firm which tenders for public works must be previously registered in the National or Provincial Contractors' Registers which grant them a maximum annual limit within which to contract, related to the following elements, among others: a) type, value and age of their equipment b) number and kind of construction works carried out during the previous five years; c) number and specialization of their technicians; d) the audited results of the last financial year; and e) their demonstrated technical capacity and quality of works carried out. 13/ The registers twice a year draw up a classification which defines the maximum construction value up to which each firm may contract. That is, it defines a maximum limit above which the firm can not deal with public entities, thus limiting its annual expansion capacity. This limitation substantially differentiates construction from other activities, in which the limits to maximum values of contracts depend expressly on the technical and financial capacity of each firm, but without any legal rules which prevent its changing those limits significantly in the medium term. 14/

13/ The Registro Nacional de Constructores de Obras Públicas is made up of advisors chosen by the registered construction firms; each one must be the head of his company. It was established on 28th. November, 1947 by Law 13.064, for the purpose of "assessment and authorization of companies". There now exist, parallel to the Registro Nacional, in which firms that contract to carry out construction and work for the national administration must be registered, Registros Provinciales y Municipales which assign values for technical and financial capacity to the firms that contract in their respective areas.

14/ An exception are the standards which determine investment requirements in some sectors, which in practice involve authorization for new plant establishment or expansion, which indirectly affect the levels of turnover. The car or cement industries are good examples, but the objectives are, of course, based on different criteria. In the industry which concerns us here, the registers were set up to eliminate improvisation in managment in the area of public works: thus, from an analysis of the true technical and financial capacity of each firm, the public institutions which contract them guarantee the contractor's suitability for the construction work in question.

It is natural, on the other hand, that these kinds of legal regulations should affect the form of organization and inter-company relationships. It happens, for example, that when a firm which works independently cannot cover the requirements of a particular tender with its contract capacity, it associates with others who are in the same situation in a "joint venture" 15/. This allows it to carry out construction works which at the end of the financial year may be reflected in increases in its contracting value, improving its relative position in the market. 16/

A second characteristic of public contracting refers, we understand, to the rules regarding price fixing. In every contract arising from a tender the initial price of a construction can only be modified in relation to cost increases of inputs used and the price of labour. In this way the customer does not pay in advance on the basis of prices which attempt to cover possible inflationary processes, but in theory achieves instead a constant adjustment of his costs to real market prices: that is, the contract is adjusted, among other possible ways, on the basis of an index arrived at from the prices of the basic inputs involved in the work.

Finally, a third characteristic of the contracting of public works arises from the precise technical conditions specified in the tender. For all public works the contracting institution prepares technical specifications which define, with varying degrees of detail, the type and the characteristics of the work to be contracted. The construction firm must adhere strictly to these specifications, so that the possibility of introducing innovations rests basically with the institution which presents the specifications. On the contrary, in private construction the possibility of innovation during construction is greater, since there is no similar document which rigidly establishes the nature of the final product. The determining factors are others (maximum explotation of space, architectural design and final cost, among others), but these are only partially defined at the beginning of the project.

15/ The "joint venture" is a consortium set up temporarily by firms interested in contracting and carrying out a specific project. In general, it may take the form of a Limited Company

16/ For this to happen the firm must, of course, have a certain negotiating power in the market. If this is not the case, not only is association difficult, but it will also only infrequently be able to absorb part of the profits. (We shall study this point more fully in Chapter 6).

Finally, if we bear in mind that every construction is unique and cannot be mass produced, given that the technical specifications and the volume of each construction work are different because of their special characteristics, we can see that the possibility of standardization within each kind of construction is significantly reduced. 17/ Only for housing is it possible to propose plans for standard units; even then, their proportion of the total volume of construction is hardly relevant, this being perhaps the most marked point of difference from the manufacturing industry. Each product "developed" requires special study, making mass production, which is the fundamental characteristic of manufacturing, difficult. 18/ This situation is influenced both by physical elements and by demand itself which, almost without exception, requires a "made to measure" product. Naturally, the complexity of the specifications for each construction vary markedly according to the submarket under consideration. But the decisive fact is that every construction, however small or straightforward, requires a special, individual design. In the manufacturing sector, this is the exception which proves the rule, significantly differentiating the former from the construction industry.

We can conclude by summarizing the dominant characteristics of the sector:

1) geographically localized demand;
2) work carried out in mobile centres;
3) lack of scale economies;
4) participation of firms which do not necessarily belong to the group construction process agents (planners, financial institutions and building);
5) technical capacity to subcontract both labour and stages of the same construction;
6) the existence of a demand with different structures for each kind of construction (which also forms differentiated sub-markets);
7) the existence of legal standards which regulate the contracting of public works: planning registers, price fixing regulations by tender, and technical specifications established by the client; and
8) finally, three elements which to a large extent define the technical structure of supply: a) variability in the kind of equipment employed in different projects; b) difficulty of standardization within each sub-markets; and c) an apparent inverse relation between the degree of specialization and the size of the firm.

17/ J. M. Aguirre Gonzalo, Tres Aspectos de la Industria de la Construcción, ICE, August, 1965, Madrid, p. 81; A. Santillana, Análisis Económico del Problema de la Vivienda, Edición Ariel, Barcelona 1972, Ch. VII; UNIDO, Construction Industry, Monograph N° 2, New York, 1969, Chs. 2 and 4.

18/ The basic reason for building not involving mass production lies in the fact that it is carried out in situ. This does not mean that there is no standardization, since this can arise from the norms themselves, and not from the finished product.

Chapter II. Market Structure

We saw in the previous chapter that the nature of the building process necessarily produces a highly fragmented market structure. It is not absolutely necessary to present rigorous statistical evidence to prove this point, since it is prefectly clear from simple empirical observation. But the mere fact that it is not a very concentrated industry must not lead us to assume that it is governed by the rules of competition. Market fragmentation is, of course, a necessary, but not a sufficient, condition for competition.

The very aggregate nature of some industries (or the way their statistics are presented) may hide dissimilar market structures. If we break down the homogeneous parts of industry, it is feasible that we shall find various typologies which, although having a common denominator (as in the case of the construction industry) may reflect few internal similarities. They probably differ in their degree of concentration, in the kind of barriers to entry they present, in the size of their scale economies and in the level of participation of foreign capital.

This kind of detailed examination is what we shall attempt to present in the next three chapters. We shall begin with an overall analysis in this and the following chapter and then conclude by analyzing each individual sub-markets (Chapter IV). In this first part, we shall study, among other aspects, the indicators of economic concentration, what kind of company mobility exists and some features of the largest firms in the sector.

I. Distribution of Firms according to Scale of Employment. Economic Concentration.

1) General Analysis

The way in which construction activity is carried out is influenced, unlike other productive sectors, by the special characteristics of the demand. As we saw in the previous chapter, each project must be carried out on the site requested by the proprietor, which means a specific work place for each project in progress. Thus, the supply has to adjust its internal structure to a demand which requires the product to be made "in situ". For this reason in theory there can be as many companies as the numbers of sites required by demand. This produces a fragmentation of supply, the extent of which is directly related to the number of customers in the market and to the possibility, or not, of internalizing scale economies.

In Argentina, the number of construction firms has hovered around 4,500 19/ since the beginning of the sixties. If we analyze all the construction firms which registered with the Registro Industrial de la Nación 20/, (See Table II, 1), we can show that, based on their levels of employment, the supply structure is characterized by :

a) the existence of a large number of purely family or individual concerns. Fifty-six per cent of the registered firms had five or less permanent employees. That is, approximately 2,600 firms lacked a structure which would allow them to undertake the building process as such on their own; their organization would apparently only allow them to carry out coordination and supervisory tasks, subcontracting labour directly or through contractors, who in fact in these cases actually carry out the different stages of construction. This situation is characteristic of housingconstruction in which, despite the large amount of labour employed, the permanent staff is small.

19/ We have taken information about the company universe from the Registro de Actividades Industriales, with which it is compulsory for all industrial companies (including builders) to be registered. The lack of census information or any other alternative source has forced us to use these statistics as our main source. They include as building companies all those firms which the SIIU (Standard International Industrial Classification) groups in section 5000.

20/ Although it is compulsory to register with the Registro, there is always the possibility that some company has not carried out the necessary procedure. A cross-check with the Registro de Empresas Contratistas de Obras Públicas shows that the number of firms registered with the Registro de Actividades Industriales is very close to that of all the construction firms operating in the country. In 1970, 3,043 companies were registered with the Registro de Obras Públicas, of which: 932 were involved in engineering projects; 773 in architectural projects and 1,347 in both kinds of construction works. The difference of 1,500 which, while registered with the Registro de Actividades Industriales do not operate as contractors for the National Administration, may indicate the number of housing construction firms which only carry out private projects (whether single or multiple family units). On the other hand, according to census information, in 1968 there were 4,403 housing construction companies in the country, a number which, when added to the 410 firms which went bankrupt during the period 1963/70, enables us to consider that the number of firms registered in 1970 is an acceptable approximation to the total sector universe, although it may be slightly lower than the true one.

Table II. 1

Building Companies According to Number of Employees

1970

Scale of Employment N° of persons employed				N° of Companies	% of Total	
more than	3000	persons		10	0,22	
2001	to 3000	"		6	0,13	
1501	to 2000	"		6	0,13	0,70
1001	to 1500	"		10	0,22	
801	to 1000	"		12	0,26	
651	to 800	"		15	0,33	1,07
501	to 650	"		22	0,48	
401	to 500	"		24	0,52	
301	to 400	"		44	0,96	
201	to 300	"		65	1,42	6,83
151	to 200	"		77	1,68	
101	to 150	"		103	2,25	
81	to 100	"		71	1,55	
66	to 80	"		82	1,79	5,11
51	to 65	"		81	1,77	
36	to 50	"		168	3,66	7,13
26	to 35	"		159	3,47	
16	to 25	"		307	6,70	23,09
11	to 15	"		273	5,96	
6	to 10	"		478	10,43	
2	to 5	"		1159	25,28	56,08
1		"		1412	30,80	
Total Companies				4584	100,00	100,00

Source : Drawn up from information taken from the Registro Industrial de la Nación. Secretaría de Desarrollo Industrial. Ministerio de Economía.

Internationally a similar situation can be observed if we analize countries as varied as Spain, the United States, France and Holland. (This can be seen, for example, in Table II. 2 and in Appendix I of this chapter).

We understand that, in the Argentine case, there are two reasons for this: on the one hand, individuals who could hardly be included in the category of "industrial firm" 21/ are registered as professional companies. And on the other, the very nature of building allows the existence of small firms with scanty capital and labour requirements which means that they act as simple coordinators of the building process 22/.

b) The previous feature is confirmed when we see, in the local context, the large number of firms which in 1970 stated that they had only one employee. As we indicated previously this situation occurs because independent professionals or technicians work autonomously in the market, carrying out projects of small unitary value 23/.

21/ They can more suitably be included in the category of independent workers than in any other typology which defines company structure. A similar situation can be observed in the U. S. A., since 81. 4% of firms have an annual turnover of less than 50, 000 dollars. (1962 data taken from P. Cassimatis. Op. cit. p. 35). For the Brazilian case, see A Construcao Habitacional do Brasil. Instituto do Desenvolvimento do Guanabara. April 1971, Ch. 5.

22/ Cassimatis considers this central to an explanation of the large number of building firms registered in the United States (more than 876, 000 in 1965). Op. cit. p. 6.

23/ Some authors confuse the client who requests a plan or building with the building contractor. They state that "when an architect's office is engaged to do a job it usually obtains it through an owner, who becomes the contractor" Arg. Aslan. Acción Pública y Privada en Vivienda. Documento N° 15. Secretaría de Estado de Vivienda. Their confusion arises from the fact that they confuse the contracting function with that of the contractor, who is in fact the person who, by concession or contract, carries out the project. The Register's information, of course, does not fall into this kind of error, so that our figures are not affected by this kind of interpretation.

Table II. 2

Percentage of Firms According to Number of Employees

	Argentina		Spain		United States		France		Holland	
	N° of companies	% of total	N° of companies	% of total	N° of companies	% of total	N° of companies	% of total	N° of companies	% of total
1-10	3049	66.5	22,377	66.0	640,886	74.8	235,900	91.1	11,833	75.5
11-50	897	19.8	9,414	27.9	188,496	22.0	18,462	7.1	3,333	21.3
51-100	234	5.1	1,137	3.4	17,136	2.0	2,860	1.1		
101-500	313	6.8	857	2.5	9,425	1.1	1,502	0.6	500	3.2
> 501	81	1.8	82	0.3	514	0.06	143	0.06		

Source : Argentina : Year 1970 - Registro Industrial de la Nación. See Appendix I.
Spain : Year 1964 - Boletín Mensual de Estadística N° 243; March 1965. It uses the scale 1-9; 10-49 and so on.
United States: Year 1966. Peter Cassimitis, op. cit. Calculated from U. S. Census Bureau's Country Business Pattens. The scale of employment differs from that of the other countries, since it takes 1-7 employees 8-49; 50-99; 100-499 and more than 500.
France : Year 1966. Annual Statistical survey of Building and Public Works, carried out by the Housing Ministry. Taken from Mercado Común Internacional. Fasc. 20. 1969, Barcelona, p. 9.
Holland : Year 1965. Economic Comission for Europe Committee on Housing, Building and Planning. H. B. P. Build/51, 15 th. September, 1969, p. 99.

Another reason can be found in one kind of violation of current labour legislation, since independent workers are obliged to register as building firms so that they may be contracted without making security deposits in unemployment funds, nor having to accept the costs of social benefits payments 24/. That is, they are registered as single-person firms in order to form a contract system similar to that which may exist between two companies.

c) It is obvious, on the other hand, if we compare the first two and the last two levels on the employment scale in Table II. 1, that there is a marked degree of heterogeneity as far as directly employed labour concerned. In 1970, 16 companies (that is, 0. 35% of the total) had a similar number of employees to the 2,600 companies in the lower levels of the scale (5 or fewer employees).

A second way of confirming the above phenomenon is by comparing the number of people employed by the larger companies with total employment for the sector. This shows us that 3. 2% of the firms registered employ approximately 50% of the permanent employees of all building companies. From another point of view, this indicates a predominance of companies whose managment organization is based on minimum work volumes and their temporary presence in the market 25/.

It follows from this, of course, that a large proportion of employment in this sector is on a temporary basis. In 1970, for example, the number of wage and salaried employees was approximately 205, 000, while actually 694, 000 people were employed that year 26/. In fact, almost 70% of those employed in the build-

---

24/ We partially analyze current labour legislation in Chapter VI.

25/ Oscar Altimir, La Vivienda en la Argentina. Aspectos Económicos. Estudios de Economía Argentina N° 5, August, 1969, Buenos Aires, p. 71.

26/ According to information from The Banco Central, The number of people employed in the building industry for the period 1964-73 was :

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
People Employees (in thousands)	362. 4	386. 3	405. 9	457. 0	536. 6	641. 9	694. 3	670, 6	703. 2	674. 5

Source: Argentina's Product and Income accounting system.

ding industry were working on a temporary basis, which makes a significant difference from the kind of employment observed in manufacturing industry, in which more stable relations predominate 27/.

e) On the other hand, permanent employment is concentrated in a limited number of firms, (see Table II. 3), since in 1970 less than 2% of the companies (those employing 500 people or more) employed 51.2% of total permanent staff. We notice at the lower end of the scale, on the other hand, that 86.3% of the companies (those which employ fewer than 50 people each) had only 10.1% of permanent employees. It is not arbitrary, therefore, to conclude that only a small number of firms maintain a high level of permanent employment which allows them to organize relatively specialized technical and labour teams.

These five characteristics drawn from a static analysis show an industry which new firms can enter with relative ease. If, for example, we check the companies registered between 1935 and 1970, we shall observe a significant growth, since the number increased from 1,550 in 1935 to 4,500 in 1970. A similar process also occured in the United States, where the number of companies more than doubled between 1947 and 1965 28/.

Locally, this growth has not been continuous, since our industrial history is strongly characterised by commercial bankruptcies. In the period 1960/70, for example, 483 companies went bankrupt, which represents approximately 11% of the total number of firms registered with the Registro de Contratistas

---

27/ In order to explain the labour relations which exist in the sector, Vázquez Vialard shows that building activity is characterised "by a high staff turnover coefficient". A significant proportion of the workers are employed in the construction of dwellings, especially urban dwellings. This kind of construction, with an average size of 2,000 m^2, requires a period of time which may be in the region of 18 months. During this period no less than ten different unions connected with the building industry are involved: excavation, masonry, reinforced concrete, wood and metal carpentry, foundry work, electricity, plastering, sanitation, painting, flooring (wood, mosaic, plastic), marblework, graniteros, lifts, heating, gas, aerials, etc. some of which also carry out successive, but shorter jobs. (...) With roadworks, bridges, dams, etc., the situation is different. Jobs last longer. Nevertheless, staff turnover is still a characteristic of large scale civil engineering works. Vázquez Vialard, Régimen Laboral en la Industria de la Construcción, in Mario L. Deveali, Tratado del Derecho del Trabajo Tomo III, Fedye Ed. La Ley, Buenos Aires, 1972, p. 429 ff.

28/ In 1947, 395,000 firms registered in the United States, while in 1965 876,000 did so (M. S. Internal Revenue Service, taken from P. Cassimatis, op. cit., p. 26.

29/. That is, two contradictory situations are juxtaposed in the same process, although in practice they illustrate a similar phenomenon: market instability.

2) Study by Kind of Construction

The overall analysis of the distribution of firms according to their rank in employment varies if, instead of considering the industry as a whole, we divide it up into firms which carry out engineering works (public works or infraestructure) and those which undertake architectural works and dwellings. A comparison between the 1963 census information and the total number of firms registered with the Industrial Register in 1970 provides us with a rough estimate, since the two sources use different company universes. The Census describes only the situation of building construction firms, while the Register covers all firms, without making any distinction between the types of activity involved. In Table II. 3 we can see that the percentage of family firms is greater when we consider only building construction firms (84.2% of the total, according to the census information). When we carry out the analysis in aggregate form -incorporating engineering - we see that the value falls to 66.5%. (Column 2 of Table II. 3) 30/. One explanation of this difference is that building construction firms employ a lower percentage of permanent labour than engineering contractors. This can be inferred from an analysis of the table, since when the public works contractors are included, the percentage of firms in the upper employment ranks increases. Another possible explanation may be derived from the different levels of labour subcontracting which, in general, is greater in building construction. This fact, seen from another point of view, would

29/ The commercial failures registered during the period 1960/70 were distributed annually as follows:

Year	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
N° of failures	26	34	32	61	71	36	38	42	41	47	55

Source : El Cronista Comercial

30/ The same differences appear when we carry out a time analysis. In 1939, for example, 2,510 establishments involved in the construction and repair of dwellings employed slightly more than double the staff employed by 185 firms involved in paving. See in this respect Luis Sommi, Los Capitales Alemanes en la Argentina. Editorial Claridad, Buenos Aires, 1945. The same observation can also be made from the 1935 census information, in which the ratios between turnover and labour employed were 4525 for the firms involved in building dwellings and other projects, and 3044 for those who only carried out infraestructure works. (From the 1935 Industrial Census).

allow us to infer that the higher relative level of employment by public works contractors would reflect in the first instance a less delegation of tasks to third parties.

On the other hand, if we consider the employment level as a suitable indicator of the size ratio between companies, it follows logically from the quantitative differences analyzed previously that the public works construction firms are, in relative terms, larger. This means, of course, that the ability to move in and out of the market is greater for housing construction firms 31/.

Table II. 3 Distribution of Building Companies According to Number of Employees, 1963 and 1970.

Scale of Employment	Percentage of total number of construction firms (1) 1963 (Census)		Percentage of total number of construction firms (in general) (2) 1970	
up to 5 people	67.9		56.1	
from 6 to 10 people	16.3		10.4	
from 11 to 25 people	10.3		12.7	
from 26 to 50 people	2.9		7.1	
from 51 to 100 people	2.6		5.1	
from 101 to 200 people	0.7	1.1	3.9	8.6
from 201 to 500 people	0.3		2.9	
from 501 to 1500 people	0.1		1.3	
more than 1500 people	-		0.5	
Total	100.0		100.0	

Note: The 1963 Economic Census uses, for methodological reasons, only building construction firms, while the Register of Industrial Activities registers all construction firms.

(1) Source: 1963 National Economic Census

(2) Source: Idem. Table II. 1

31/ This situation has been encouraged by current labour legislation in the sector (which shall try to describe more fully in Chapter VI).

II. Distribution of Firms According to Turnover Value.

So far we have examined the market structure taking the relative level of employment as the basic indicator. This has allowed us to make a superficial description of the structure of supply, but has not yet offered us any information concerning the degree of company concentration.

Despite the technical problems presented in this sector by the measurement of the value of production 32/, we have been able to construct an initial temporal indicator of the growth of absolute concentration, taking as our starting point the share of the turnover of the 40 main companies (Table II.5 gross production of the whole sector). When we compare these indicators with the indices of absolute concentration for the manufacturing sector taken from other studies, it can be observed that the building industry is a branch with showing only slight concentration 33/. If we compare it, for example, with the indicators of 146 branches of the manufacturing sector, we shall see that its level of concentration is higher only than that of furniture manufacture, brick production and bread making 34/.

32/ In general it is difficult to obtain the precise total value of constructions which have in fact been carried out. This is because some of the new constructions are not always registered (is a rule, improvements or extensions) and also because of the method used to quantify the value, since trends are usually extrapolated from very small samples. The Central Bank, for example, uses a sample of 120 firms of a universe of approximately 4,600. Logically, coverage is not very full.

33/ Sales made through Joint Ventures are not included in company sales. In this respect, the level of concentration is relatively higher. This can be seen if we consider the values of capacity to contract assigned by the registers as an indicator of concentration. For example, it can be observed that the four largest companies in 1975 controlled 5.358% of the total, while the first one controlled 2.656%. In relation to 1968 this may show an increase in the degree of concentration or a truer indication, since it includes both company and joint venture turnover.

34/ Several authors, La Concentración en la Industria Argentina in 1964, in El Desarrollo Industrial en la Argentina: Sustitución de Importaciones, Concentración Económica y Capital Extranjero (1950-1970) Conade, Bs. As., 1971, pp. 49-59.

Table II. 5 Share of the 5, 10, 20 and 40 Leading Building Companies in Total Building Investment
(Absolute Concentration)

YEAR	First 5	First 10	First 20	First 40
	%	%	%	%
1963	4.5	6.9	9.8	12.6
1964	4.2	6.5	9.9	12.1
1965	3.2	4.6	6.6	8.8
1966	3.3	4.7	7.0	9.8
1967	3.1	4.5	6.6	9.0
1968	3.6	4.8	6.8	9.4

Source: Author's estimates. (Gross fixed domestic investment in building) Taken from: Banco Central de la República Argentina. Accounts system of Argentina's product and income, p. 112. Table N° 32.

This kind of comparison between sectors of branches which have different shares in the overall gross product naturally reduces the importance of the index of concentration by not taking into account the relative weight each one has in the overall GDP. In the case of the construction sector, for example, it can be observed that its share in the last few years has been slightly over half that of the agricultural and livestock sector 35/. In other words, the first 20 companies

35/
Share of the Construction, Manufacutring and Agriculture and Livestock Sectors In the Overall Gross Product

Year	Construction Industry	Manufacturing Industry	Agriculture and Livestock
1968	5,5	45,4	8,8
1969	6,1	44,8	8,9
1970	6,3	44,5	9,3
1971	5,7	44,9	9,7
1972	5,4	46,7	10,2
1973	5,4	46,1	10,4

Source: Banco Central. Sistema de cuentas del producto en ingreso de la Argentina. Volume II, 1975.

in 1968 shared 5.8% of a value which represented approximately 5.5% of the country's total gross product 36/. In this sense, the aggregate nature of the construction industry does not allow the true structure of the market to be clearly explained. It is natural that it should vary - in relation to the overall indicators - when we carry out the analysis, dividing up again each of the submarkets which makes up the industry. In concrete terms: if we make a first division, taking into account only the public works construction companies, we note that the share of the first 5 increases to a value of nearly 9% (Table II.6), significantly, higher than the 3.5% given by the overall indicator (Table II.5). That is, we show once more that economic concentration increases as the industry as a whole is broken down.

Moreover, within the industry taken as a whole, significant differences also appear in the share of the main firms in relation to firms with a lower relative turnover value 37/, if we take 5, 10, 20 and 40 main firms in relation to the total number of firms in the sector. (Table II.7)

Taking into account the mean turnover between groups of firms, we observe that the first 5 companies have a turnover approximately 36 times that of 99% of those found lower on the scale 38/. This index reveals that the differences in size within the industry are significant, a feature not unique to local industry, since in the United States, for example, 0.2% of firms controlled 11.2% of the sector's total production in 1962; or, from another point of view, 81.4% of the smallest firms had a turnover of only

---

36/ That is, the overall concentration indicator allows us to infer, given the importance of the branch in the GDP, the existence of large firms (the first 10, for example). But when the fixed gross domestic investment which includes all kinds of building is used as a basis comparison with other branches naturally obscures this fact.

37/ The index of relative concentration is defined by the accumulated percentage of the value of production, which is explained by the accumulated percentage of firms in the branch. See El Desarrollo Industrial en la Argentina, Secretaría de Planeamiento y Acción de Gobierno. op. cit. p. 8, and P. Sylos Labini, Oligopolio y Progreso Técnico, Editorial Oikos-tau, Barcelona, 1966, pp. 18-20.

38/ Another way of looking at the same phenomenon is by the distribution of firms according to their turnover ranking. This appears quite clearly in the following table, which shows significant differences between the firms with a

12.7% of total production 39/.

Table II.6 Share of the 5 and 10 Main Construction Firms in Total Public Works

YEAR	Share of the 5 Main Firms	Share of the 10 Main Firms (.)
1963	9.6	14.6
1964	9.4	14.9
1965	7.8	12.0
1966	8.7	12.8
1967	7.9	11.5
1968	8.6	11.9

Source: Idem Table II.5

(.) We take into account the 10 main public work building companies.

higher relative turnover and those lower on the scale.

Distribution of Firms According to Turnover Level (1973)

Level of Turnover in Thousand of 1973	N° of Companies	Percentage of Firms in relation to the Total
more than 400,000	1	0.02
between 200,001 and 400.000	1	0.02
" 100.001 and 200.000	6	0.13
" 50.001 and 100.000	16	0.36
" 25,001 and 50.000	34	0.74
" 10,001 and 25,000	88	1.93
" 5,001 and 10,000	119	2.60
less than 5,000	4309	94.02

Source: Drawn up from information gathered from the Register of Industrial Activities.

39/ D. Cassimatis op. cit. pp. 34 & 35.

Table II. 7 Relative Concentration

Number of Companies		Percentage of Total Firms (1)	Market Share (mean share) % (2)	2/1
5	first	0, 1	3, 6	36, 0
10	first	0, 2	5, 3	26, 5
20	first	0, 5	7, 6	15, 2
40	first	1, 0	10, 5	10, 5
4, 600	remaining	99, 0	89, 5	0, 9

III The Largest Firms in the Sector.

From the ranking of the 40 main building firms in the period 1963/1968 (which we set out in Appendix II of this chapter) we can show that:

a) There is relative stability in the leadership of the sector, since four companies: Sade, Techint, Panedile and Impresit-Sideco have always registered the highest annual volumes of construction. If we define as permanently large those cmopanies which had a year by year turnover of 250 million $ m/n. (at 1963 prices), we observe that only seven firms fall into this category (the four previous ones, plus Mellor Goodwin, Empresa Argentina de Construcciones Públicas y Christiani y Nielsen) ✱/.

b) Exception for 1964, Sade has remained constantly first in the ranking and its turnover value since 1965 has been three times the level of the third firm in the sector 40/.

✱/ If we check this information with that given in the following chapter we can see that six of the seven major companies are foreign subsidiaries.

40/ These differences are significant, since for this period they can only be compared to those registered in the tobacco sector. In other branches, on the other hand, such as rubber or vehicles differences have ranged between 25% and 30%. In the food industry, for example, they were of 10% or 15% and in the manufacture of chemical products or drinks slightly below 100%.

c) The turnover value of the large firms was several times higher than that of the firms situated in the levels immediately below them. A result which follows, of course, from the percentage differences in turnover between firms:

Table II. 10

YEAR	Difference between 1st and 5 th firm	Difference between 1 st and 10 th firm	Difference between 1 st and 40 th firm	Difference between 10th and 40 th firm
1963	210%	310%	926%	483%
1964	170%	303%	910%	300%
1965	196%	325%	935%	290%
1966	363%	566%	1280%	230%
1967	320%	400%	1150%	240%
1968	416%	610%	1160%	180%

Source: author's estimates based on Appendix II.

It can also be seen that the difference between the turnover of the first firm in the ranking and that of the remainder (1st-5th; 1st-10th; and 1st-40th) increases with the time, which shows that there is a trend increase in the relative size of the first firm. On the other hand, the distance between the 10th and the 40th decreases, which leads to a grouping of medium-sized firms round a value where there tends to be less spread - even though this value moves further and further from that registered by the large firms 41/.

41/ The same situation can be observed in Europe and the United States. A study of the structure of industry in various European countries shows that "structural changes in the construction industry usually occur slowly but steadily. (...) In most countries the number of small and large firms increases, or else they show an increasing proportion of total production, while the number of medium-sized firms declines". La Industria de la Construcción. Coyuntura y Tendencias en Algunos Países Europeos. Mercado Común Internacional. Op. cit. p. 2. In the case of Europe, this change is usually explained by modifications in the building methods used in Europe, since on the one hand there is a tendency towards the use of more mechanized (more capital intensive) methods, while on the other, maintenance and modernization work, which favours small companies in particular, is encouraged. That is, the supply structure tends to polarize and the share of the medium-sized firms is declines.

If we compare these observations with the indices of economic concentration (Table II.6), we can infer that the percentage growth in turnover of the first firm in relation to the others is counter-balanced by the bunching of the medium firms, which makes the index of economic concentration show relative stability.

IV. Company Mobility

If we again consider as large firms those which in the period 1963/1969 had a turnover of more than 250 million $ m/n, and as medium ones those which had a turnover of between 30 and 250 million $ m/n - in both cases at 1963 prices -, we shall observe the following points with reference to company mobility:

a) of the 28 firms considered large in one year, which become medium-sized in the following, only four are foreign. Or, looking at it from another angle, of the total number of large firms which lose their relative positions in the market, 86% are backed by local capital. On the other hand if we analyze the four large foreign companies separately, we shal observe a rising turnover rate, which has put them among the permanently large firms. This would allow us to infer that of the total number of companies which move from the category of large to medium size, those representing local capital in fact make up 93%.

b) On the other hand, 11 of the companies which follow the above mentioned course, never return to the category of large firms. Of these, only one is foreign, and ten local: this means that 25% of the foreign branches which lose their relative positions fail to recover their previous position, while for the local firms the percentage rises to 41%, or, in other words, the foreign branches recover their positions with greater ease than local firms 42/.

c) in the period analyzed, 37 companies move from the medium-sized category to the large. Of these, only 21% are backed by foreign capital.

d) Comparing points a and c, we can then show that the percentage of foreign firms which moves from the medium-sized category to the large within the total (21% is higher than the percentage of foreign firms which follow the opposite process (14% or 7%, according to how we consider the dependent firms). From this we can state that the prevailing trend among foreign firms

---

42/ The firm with foreign capital is Construcciones Vianinni which is taker over directly by the consortium of Italian firms.

is to improve their relative positions in the market, or in other words, to occupy stronger and stronger leadership positions at the expense of local firms.

e) Finally we can point out that there is a high degree of mobility among the firms situated from the 5th position upwards in the ranking. The differences in their volumes of turnover fall significantly and usually fluctuate between levels 10 and 60 with relative ease. The firms in this situation are mainly local ones, whereas, as we have already described, the foreign capital firms tend to consolidate their leadership of the sector. In this respect, it can be stated that there is a differential degree of mobility according to the origin of the capital of each firm. On the basis of such conclusion, we can logically draw an initial dividing line in the overall market structure by means of an analysis of the share of foreign capital in the sector, a point we shall examine in the following chapter.

APPENDIX I

Additional Information

Supply Structure: United States of America, Spain, France and Sweden.

U.S.A. : Construction Firms (according to scale of employment)

Scale of Employment		Number of Firms	Percentage of Total	Accumulated Percentage
1 to 3	people	462,672	54.0	–
4 to 7	"	178,214	20.8	74.8
8 to 19	"	133,660	15.6	90.4
20 to 49	"	54,836	6.4	96.8
50 to 99	"	17,136	2.0	98.8
100 to 249	"	7,712	0.9	99.7
250 to 499	"	1,713	0.2	99.9
more than 500	"	514	0.06	100.0

Source: Idem Table II, 2

France: Construction Firms (according to scale of employment)

Scale of Employment		Number of Firms	Percentage of Total	Accumulated Percentage
Independent worker		87,800	33.9	–
1 to 5	people	125,380	48.4	82.3
6 to 10	"	22,640	8.8	91.1
11 to 20	"	11,397	4.4	95.5
21 to 50	"	7,065	2,7	98.2
51 to 100	"	2,860	1.1	99.3
101 to 200	"	1,055	0.4	99.7
201 to 500	"	447	0,2	99.9
more than 500	"	143	0,06	100.0

Source: idem Table II, 2.

Sweden: Distribution of Building Construction Firms (according to scale of employment)

Scale of Employment		Number of Firms 1965	1966
2-24	people	3,393	3,932
25-99	"	613	636
100-749	"	174	152
More than 750	"	26	30
Total	"	4,206	4,750

Source: Mercado Común Internacional. Op. cit., p. 17.

Spain: Construction Firms (according to scale of employment)
1964

Scale of Employment		Number of Firms	Percentage of Total	Accumulated Total
1 to 3	people	12,576	37.1	--
4 to 9	"	9,801	28.9	66.0
10 to 24	"	6,628	19.7	85.7
25 to 49	"	2,786	8.2	93.9
50 to 99	"	1,137	3.35	97.2
100 to 109	"	554	1.6	98.8
200 to 499	"	303	0,9	99.7
500 to 1000	"	59	0.2	99.9
more than 1000	"	23	0.1	100.0
Total		33,867	100.0	100.0

Source: idem Table II, 2.

APPENDIX II

Annual Ranking of Building Firms. 1963-1968 (*)

Position	Firm	Country of Origin of Capital ★	Turnover Value ★★
1	SADE	Italy-USA	1,641.3
2	Techint	Italy	1,406.9
3	Impresit Sideco	Italy	1,360.0
4	Panedile	Italy	815.8
5	Polledo	Argentina	768.2
6	Geopé	Argentina	758.2
7	Pueyrredon Construcciones	Argentina	696.8
8	Mellor Goodwin	U.S.A.	676.2
9	Empresa Argentina de Constr. Públ.	Argentina	537.1
10	Ormas S.A.	Argentina	531.8
11	Elina, Electro Industrias Arg.	Italy	524.5
12	Christiani y Nielsen	USA-Denmark	496.4
13	EACA	Argentina	464.1
14	Construcciones Vianini	Italy	463.6
15	Trovato y Cía.	Argentina	396.9
16	Seminara Empresa Constructora	Argentina	344.9
17	Cia. Gral. de Construcciones	Argentina	342.6
18	Antonio D'Elia S.A.	Argentina	323.7
19	Albardon	Argentina	314.1
20	Marengo	Argentina	295.2
21	Halliburton S.A.	U.S.A.	292.8
22	Ing. y Construcciones Kaiser	U.S.A. (?)	280.9
23	Red Caminera Argentina	Argentina	270.0
24	Ohen Argentina	Argentina	269.8
25	Ga. Sud Argentina de Constrcciones	Argentina	245.9
26	Lanusse Construcciones	Argentina	231.8
27	SACOAR	Argentina	226.6
28	Lix Klett	Argentina	221.5
29	(1)	-	220.9
30	Gesiemes	Argentina	217.0
31	Industria Arg. de Const. y Urban.	Argentina	200.1
32	(1)	-	199.4
33	Cia. Gral. de Pavimentación	Argentina	194.3
34	(1)	-	188.3
35	Solari Bacigalupi S.A.	Argentina	185.6
36	(1)	-	179.4
37	(1)	-	176.7
38	Coindel S.A.	Argentina	168.6
39	(1)	-	168.2
40	Conovial	Argentina	140.3

(*) Source: Balance Sheets

★ See Chapter III

★★ In millions of today's pesos

(1) It has not been possible to identify them

1964

Position	Firm	Country of Origin of Capital *	Turnover Value * *
1	Impresit Sideco	Italy	1,809.3
2	SADE	Italy	1,643.4
3	Techint	Italy	1,268.9
4	Panedile	Italy	1,162.1
5	Construcciones Polledo S.A.	Argentin	1,068.2
6	Construcciones Vianini S.A.	Italy	1,054.1
7	Mellor Goodwin	U.S.A.	861.7
8	Pueyrredon Construcciones	Argentina	827.7
9	Geopé	Argentina	735.3
10	Emp. Arg. de Cont. Públicas	Argentina	597.5
11	Albardon	Argentina	567.3
12	Elina Electro Ind.	Italy	556.7
13	Christiani y Nielsen	U.S.A. -Denmark	449.8
14	Conevial	Argentina	427.6
15	Antonio D'Elia S.A. Constructora	Argentina	408.8
16	Crivelli, Cuenya y Goicoa .A.	Argentina	403.2
17	Seminara Empresa Constructora	Argentina	368.8
18	EACA	Argentina	352.3
19	Ind. Arg. de Const. y Urban.	Argentina	340.8
20	Ormas S.A.	Argentina	327.5
21	Cía.Gral. de Pavimentación S.A.	Argentina	325.8
22	Halliburton Argentina	U.S.A.	289.5
23	Cia. Gral. de Constr. S.A.	Argentina	279.9
24	Ing. y Const. Kaiser	U.S.A. (?)	287.7
25	Cía. Sud. Arg. de Constr. S.A.	Argentina	278.1
26	Petersen Thiele y Cruz S.A.	Argentina	271.8
27	Vialco	Argentina	264.8
28	Marengo S.A.	Argentina	262.5
29	Red Caminera Argentina	Argentina	259.7
30	A.M.Y.R. S.A.	Argentina	254.2
31	Corti S.A. de Electrización	Argentina	252.5
32	Gesiemes S.A.	Italy	242.5
33	Lanusse Construcciones	Argentina	237.3
34	Trovato y Cia. S.A.	Argentina	236.0
35	Construc. de Viv. Fam. S A.	Argentina	235.3
36	Ohen Obras Hidráulicas	ıtina	228.3
37	Lix Klett	ıtina	226.5
38	Inalruco	ıtina	222.1
39	Demaco S.A.		211.2
40	SACOAR	ıtina	198.6

1965

Position	Firm	Country of Origin of Capital *	Turnover Value * *
1	SADE	Italy-USA	2,107.2
2	Techint S. A.	Italy	1,477.7
3	Impresit Sideco S. A.	Italy	1,341.3
4	Panedile Arg. S. A.	Italy	1,271.7
5	Polledo S. A.	Argentina	1,076.6
6	Mellor Goodwin	U. S. A.	1,020.1
7	Empresa Arg. de Constr. Públicas	Argentina	838.9
8	Geopé Cia. Gral. de Obras	Argentina	688.7
9	Conovial S. A.	Argentina	684.0
10	Ingeniería y Const. Kaiser	U. S. A. (?)	648.1
11	Construcciones Vianini	Italy	583.5
12	Crivelli Cuenya y Goicoa S. A.	Argentina	568.3
13	Albardon S. A.	Argentina	557.8
14	Holliburton Argentina	U. S. A.	551.7
15	Christiani y Nielsen S. A.	USA-Denmark	537.8
16	Ind. Arg. de Const. y Urbanizaciones	Argentina	466.6
17	Vialco S. A.	Argentina	437.1
18	SACOAR S. A.	Argentina	389.4
19	Antonio D'Elia S. A.	Argentina	383.7
20	Pueyrredon Construcciones	Argentina	375.6
21	Elina Electro Ing. Argentina	Italy	349.3
22	Field Argentina	U. S. A.	345.6
23	Demaco S. A.	Italy	342.0
24	Chen Obras Hidráulicas S. A.	Argentina	337.7
25	Empresa Argentina de Cemento Arm.	Argentina	332.9
26	Lix Klett S. A.	Argentina	312.6
27	Marengo S. A.	Argentina	305.5
28	Seminara Empresa Constructora	Argentina	301.2
29	Red Caminera Argentina S. A.	Argentina	297.4
30	Enrique Coden y Cia. S. A.	Argentina	291.2
31	Alefa S. A.	Argentina	288.9
32	Codel S. A.	Argentina	278.6
33	Caputo S. A.	Argentina	258.8
34	Petersen Thiele y Cruz	Argentina	250.3
35	(1)	-	233.7
36	Gesiemes S. A.	Italy	230.8
37	Solari Bacigalupi S. A.	Argentina	230.2
38	Constructora de Viviendas Fam.	Argentina	230.1
39	Corti S. A. de Electrificación	Argentina	227.2
40	Ormas S. A.	Argentina	225.2

1966

Position	Firm	Country of Origin of Capital ★	Turnover Value ★ ★
1	SADE	Italy-USA	4,657.3
2	Panedile Argentina S. A.	Italy	2,061.8
3	Emp. Arg. de Constr. Públicas	Argentina	1,378.1
4	Mellor Goodwin	U. S. A.	1,338.9
5	Techint S. A.	Italy	1,282.9
6	Ing. y Constr. Kaiser	U. S. A. (?)	1,105.2
7	Conovial	Argentina	1,062.0
8	Viviendas Tarzan	Argentina	931.2
9	Christiani y Nielsen S. A.	USA-Denmark	921.5
10	Crivelli Cuenya y Goicoa S. A.	Argentina	822.3
11	Impresit Sideco S. A.	Italy	876.9
12	Sideco (Silos Demarco)	Italy	865.7
13	Elina Electro Inc. Argentina	Italy	818.0
14	Supercemento	Italy-France	805.9
15	Somerfin S. A.	Argentina	801.0
16	Polledo S. A.	Argentina	793.8
17	Promobra S. A.	Argentina	783.5
18	Caputo S. A.	Argentina	761.5
19	Enrique Coden y Cia. S. A.	Argentina	749.2
20	Holliburton Argentina	U. S. A.	716.3
21	Ing. Arg. de Const. y Urbanizac.	Argentina	657.9
22	Vialco S. A.	Argentina	641.2
23	Seminara Empresa Constructoa	Argentina	611.0
24	Geopé Cia. Gral. de Obras	Argentina	604.2
25	Albardon	Argentina	594.5
26	EACA S. A.	Argentina	557.0
27	Ohen Obras Hidráulicas	Argentina	533.7
28	A. G. Mc Kee y Co. Arg.	U. S. A.	530.4
29	Marengo S. A.	Argentina	486.9
30	Bava Seery y Lijtmaer S. A.	Argentina	462.9
31	Antonio D'Elia S. A.	Argentina	461.1
32	SACOAR S. A.	Argentina	436.6
33	Lix Klett	Argentina	431.9
34	Pilotes Franki S. A.	Belgium	423.4
35	Brave Fontana y Nicastro S. A.	Argentina	420.0
36	Loimar S. A.	Argentina	401.3
37	Codel S. A.	Argentina	382.2
38	Salas y Billoch	Argentina	377.0
39	Demaco S. A.	Italy	363.5
40	C. A. V. E. S. A.	Argentina	359.0

1967

Position	Firm	Country of Origin of Capital	Turnover Value
1	SADE	Italy-USA	5,454.9
2	Panedile Argentina S. A.	Italy	2,887.6
3	Emp. Arg. de Const. Públicas	Argentina	2,185.7
4	Promobra	Argentina	1,765.9
5	Ing. y Const. Kaiser	U. S. A. (?)	1,712.8
6	Mellor Goodwin	U. S. A.	1,712.0
7	Techint S. A.	Italy	1,572.5
8	Vialco S. A.	Argentina	1,516.6
9	Sideco Silos Demaco y Cia.	Italy	1,422.9
10	Holliburton Argentina	U. S. A.	1,407.9
11	Conovial	Argentina	1,157.5
12	Field Argentina	U. S. A.	1,155.1
13	Impresit Sideco S. A.	Italy	1,110.9
14	Christiani y Nielsen S. A.	U. S. A. -Denmark	1,044.5
15	Ind. Arg. de Const. y Urbaniz.	Argentina	1,040.2
16	Seminara Empresa Constructora	Argentina	944.3
17	Albardon S. A.	Argentina	951.8
18	Red Caminera Argentina	Argentina	857.1
19	Supercemento	Italy-France	842.6
20	Caputo S. A.	Argentina	833.9
21	Geopé S. A.	Argentina	752.8
22	Polledo S. A.	Argentina	746.3
23	Marengo S. A.	Argentina	744.0
24	Eugenio Grassetto	Argentina	740.3
25	Lix Klett	Argentina	736.7
26	Vicente Robles	Argentina	711.9
27	Ohen Obras Hidráulicas	Argentina	707.7
28	Pilotes Franki	Belgium	660.7
29	Odisa S. A.	Argentina	641.1
30	Viviendas Tarzán	Argentina	612.7
31	Salas Billoch S. A.	Argentina	601.6
32	Sacoar S. A.	Argentina	569.7
33	Pueyrredon Construcciones	Argentina	552.7
34	Elina Electro Ind. Arg.	Italy	545.9
35	Ing. Martinez Construcciones	Argentina	538.2
36	Lanusse Construcciones	Argentina	532.5
37	Empresa Arg. de Cemento Armado	Argentina	530.8
38	Construgral S. A.	Argentina	528.7
39	Mirafiori S. A.	Italy	489.1
40	Mulville y Cia. S. A.	Argentina	479.5

1968

Position	Firm	Country of Origin of Capital	Turnover Value
1	SADE	Italy-USA	8,687.8
2	Impresit Sideco S. A.	Italy	5,696.3
3	Techint S. A.	Italy	2,786.2
4	Penedile S. A.	Italy	2,660.5
5	Vialco S. A.	Argentina	2,088.4
6	Ohen Obras Hidráulicas	Argentina	1,519.4
7	Pueyrredon Contrucciones	Argentina	1,470.5
8	Albardon S. A.	Argentina	1,464.4
9	Supercemento	Italy-France	1,440.3
10	Emp. Arg. de Const. Públicas	Argentina	1,432.1
11	Loimar S. A.	Argentina	1,384.8
12	Ind. Arg. de Const. y Urbaniz.	Argentina	1,344.3
13	Marengo S. A.	Argentina	1,343.1
14	Lix Klett	Argentina	1,315.4
15	Halliburton	U. S. A.	1,287.2
16	Geopé S. A.	Argentina	1,265.5
17	Vicente Robles S. A.	Argentina	1,241.1
18	Perales Aguiar S. A.	Argentina	1,209.9
19	Sacoar S. A.	Argentina	1,203.8
20	Ingeniero Martinez	Argentina	1,199.2
21	Promobra S. A.	Argentina	1,199.2
22	Sebastián Maronese S. A.	Argentina	1,196.8
23	Cia. Sud Arg. de Constr.	Argentina	1,126.5
24	Conevial S. A.	Argentina	1,118.3
25	Somerfin S. A.	Argentina	1,077.3
26	Bave, Fonatana Nicastro S. A.	Argentina	1,001.1
27	Christiani y Nielsen	USA-Denmark	967.3
28	Elina Electro Ind. Arg.	Italy	941.9
29	Seminara Empresa Constructora	Argentina	932.8
30	Polledo S. A.	Argentina	923.4
31	Field Argentina	U. S. A.	917.9
32	EACA S. A.	Argentina	912.6
33	ICOFISA S. A.	Argentina	911.4
34	Lanusse Construcciones	Argentina	894.9
35	Vivendas Tarzán	Argentina	857.2
36	Pilotes Franki	Belgium	817.6
37	Salas y Billoch Cia. de Const. S. A.	Argentina	812.4
38	Ing. y Constr. Kaiser	USA (?)	797.7
39	Adelphia S. A.	Argentina	794.3
40	Odisa S. A.	Argentina	783.4

Chapter III. Participation of Fims Backed by Foreign Capital

The share a firm backed by foreign capital has in almost any of the industrial sectors can usually be seen to have a direct relation to the degree of economic concentration. This situation can be confirmed in the construction industry in which the overall fragmentation of supply correlates with a low share of foreign capital (if we compare it with a number of other branches of industry). But this low share does not mean that foreign capital plays a marginal role in the market: if we consider it from the point of view of the relative size of the branch companies, it can be deduced that it has substantial weight. The largest firms for example, are foreign and in general have always achieved a stability which differentiates them from local companies.

In this chapter we shall show that this situation is not exclusive to the sixties and seventies in Argentina, but that it takes off, so to speak, with the beginning of large scale building. To prove this, we shall work on four aspects which allow us, to some extent, to break down the supply structure we analyzed in the previous chapter. We shall try, in the first place, to describe the branches which currently have a share in the internal market; we shall then give a brief historical description of their role in the sector; having done that, we shall describe the reasons for their establishment in the local market (taking as our starting point the theories behind foreign investment) and finally, we shall analyze the degree of participation of the foreign firms, both as individuals and as several economic groups controlled by multinational consortia.

1. Foreign Subsidiaries which Currently have a Share in the Internal Market.

During the period 1970-75 32 foreign firms, whose general features we describe in Table III.1, have had a share in the local market.

Table III. 1 Firms Backed by Foreign Capital Operating in Argentina (1975)

Name of subsidiary	Percentage of Foreign Capital	Parent Company	Country of Origin	Percentage Capital	Percentage Votes	Branch of Activity	Comments
A. Christiani & Nielsen S. A.	100	A. Christiani & Nielsen S. A.	U. S. A. Denmark	100	100	Building	The Berthel Group, linked with a cultural and financial activities, controls the firm's shares at the present time
A. G. McKee & Co. Arg. S. A. de Ing. y Const.	90	A. McKee & Co Eng. & Contr.	U. S. A.	90	90	a) Engineering & Building service b) Hire of building equipment	
Acueductos S. A.	60	a) Materiales y Tubos Bonna S. A. b) Socea S. A.	Spain France	54. 28	54. 28	a) Public Work const. b) Manufacture of prestressed concrete pipes	Jaime B. Coll (Arg.) owned 40% of the firm's capital in 1973
Austin Sudamericana S. A.	99. 9	The Austin Co.	U. S. A.	99. 9	99. 9	a) Engineering & building services b)Rent of equipment	

Chicago Bridge & Iron Co.	100	Chicago Bridge & Iron Co.	U. S. A.	100	100	Technical advice on meral structures assembly	
Dragados y Construcciones S. A.	100	Dragados y Constr. S. A.	Spain	100	100	a) Hydraulic projects b) General building	Both firms in practice combine to form a single company, even though they are registered as independent firms
DYCASA, Dragados y Const. Argentinas S. A.	48, 5	Dragados y Const. S. A.	Spain	48, 5	48. 5	a) Hydraulic projects b) General building	
DYWIDAG S. A.	100	Dyckerhoff und Widmann A. G.	Germany	100	100	a) Prestressed systems b) Engineering service for road construction	Dywidag is associated with Aceros Sima S. A. to which it licenses steel making processes for prestressed concrete
Entrecanales y Tavora S. A. (Suc. Arg.)	100	Entrecanales y Tavora S. A.	Spain	100	100	Plans & execution of several kinds of projects	In 1973 it had an investment of US$ 143. 000
Field Arg. S. A.	S/d	Conway	U. S. A.	s/d	s/d	Housing constr.	Conway Co, is engaged in oil transportation
Geosonda Cimentaciones Especiales S. A. Constructora	96	a) Impresit Sideco S. A. b) Geosonda Holding	Italy	49. 5 46. 5	49, 5 46. 5	Building	Impresit Sideco is a local firm backed by foreign capital

Hochtieff S. A.	100	P. T. A. Hochtieff A. G. (Für Hoch und Tiefbauten	Germany	100	100	Public work const.	
Impregilo S. A.	100	-Impresse Italiane All' Estero Spa.	Italy	33. 3	33. 3	Public work construction	The firm of U. Girola in 1973 registered as an independent foreign firm through its direct participation in the building of the Chaco-Corrientes Bridge
		-Imprese Umberto Girola de César Girola	Italy	33. 3	33. 3		
		-Impresa Ing. Lodigiani SpA	Italy	33. 3	33. 3		
Imprese Italiane All' Estero SpA	100	Imprese Italiane All'Estero SpA	Italy	100	100	Building	At the moment engaged in property rentals
Impresit Sideco S. A.	49	Imprese Italiane SpA	Italy	49	49	General building	Demaco S. A., a local firm backed by foreign capital holds 40% of the capital & the votes
Mellor Goodwin S. A.	35. 89	a) Combustión Eng. Inc.	U. S. A.	8. 23	4. 89	Manufacture & Install. of steam generating plants	No information has been obtained regarding the remaining 64% of the capital
		b) Clyde Crone & Both		4. 63	2. 75		
		c) Int. Combust. Ltd.		23. 03	13. 67		

Mellor Abengoa S. A.	s/d	s/d				Electromechanical Assembly	In 1973 foreign investment was US$ 1,154,200
Novobra Empresa Constr. S. R. L.	100	a)Ficanob b) Gagneraud P y F S. A. c) Gagneraud Francis d) Gagneraud F. et Michel	France France France France	50.99 48.81 0.09 0.09	50.99 48.81 0.09 0.09	a) Public works construction b) Quarries & steel work ser-	It was set up with funds from the sale of the Port of Rosario which was operated by French private capital
Panedile Arg. S. A.	48.99	Societá Italiana per Condotte d' Acqua	Italy	48.99	48.99	a) Public works construction b) Building & sale of real state	Duilio Marinucci an italian resident, holds 51.01% of the capital & votes
Pirelli S. A.	99.9	Dunlop-Pirelli Unión	England Italy	99.9	99.9	Manufacture & installation of cables & conductors. Electromechanical projects	The installation department is part of Industrias Pirelli S. A.
Rodio Arg. S. A.	99.44	Holding Rodio S. A.	Switzerland	99.44	99.44	a) Installation of piles b) Drilling for Construction	
SADE S. A.	94.86 *	a)Financie Eléctrica b) Compagnia Generale di Electricitá c) Indufisa S. A. d) Félix Orsi	Italy Italy E. E. U. U	47.50 41.06 4.71 1.59	47.50 41.06 4.71 1.59	Construction of public and private works	Indufisa S. A. is a local firm backed by foreign capital The Compagnia Generale di Elettricitá is a subsidiary of the General Electric Co. of U. S. A.

SOCEA (Societé Eau et Assatnissement)	100	Societé Eau et Assatnissement	France	s/d	s/d	Sewerage & Drainage works	Socea of France owns some of the share capital of Acueductos S. A.
Sociedad Comercial del Plata S. A.	70.28	a)Societé Priveé de Banque et d'Gerance	Switzerland	30.49	30.49		
		b) Motor Columbus S. A.	Switzerland	8.00	8.00		The Banco Nacional de Desarrollo holds 8.27% of the capital and 12.54% of the votes
		c) Soc. Suisse Americaine d'Electricité	do.	4.53	6.87	Housing construction	
		d)Crédit Suisse	do.	3.59	5.44		
		e) Others	do.	4.16	6.32		
Solel Boneh's Overseas & Harbour Works Co. Ltd.	100	Solel Boneh International Ltd.	Israel	100	100	Housing Construction	
Spooner del Plata Ltd.	100	Spooner del Plata Ltd.	England	100	100	Industrial construction	
STUB (Suc. Arg.)	100	Societé Technique pour l'Utilisation de la Précomprentre	France	100	100	Engineering studies & technical	In 1973 foreign investment was US$ 6.000
Supercemento S. A.	s/d	ETAFINTRA Etablissement Financier de Travaux Publics	France	s/d	s/d	a)Public works construction b) Manufacture of high resistance pipes	

Techint S. A.	100	a)A. Rocca y Cía. S. A. b)Techint Eng. Co.	- Panama	51.0 49.00	71.11 28.89	Building	A. Rocca y Cía is a local firm backed by foreign capital
Vianinni Dragaggi Lavori Marittimi SpA	100	Vianinni SpA	Italy	100	100	Public Works construction	
Viviendas Condal S. A.	10	Karpik Ferdinand	Germany	10	10	Premoulded dwellings	
Viviendas El Gaucho S. A.	17	Karpik Ferdinand	Germany	17	17	Premoulded dwellings	Both firms are associatd with Shil Hogar S. A.

Note: ✱ Since 1974/75 the local Pérez Comparc group (also connected with Italian interests) has formed part of the share capital of SADE.

Building Firms Controlled by Foreign Subsidiaries Established in this Country

Name of subsidiary	Percentage of Foreign	Parent Company	Country of Origin	Percentage Capital	Percentage Votes	Branch of Activity	Comments
Argau S. A.	19.82	Sociedad Comercial del Plata S. A.	-	19.82	19.82	Technical services for construction	SCP. S. A. is a local firm backed by foreign capital
Gesiemes S. A.	19.52	Sociedad Comercial del Plata S. A.	-	19.52	19.52	Construction firm	SCP S. A. is a local firm backed by foreign capital
Macovial SACIAFI	46.75	Novobra Empresa Constructora	-	46.75	46.75	Technical services for building	Novobra is a local firm backed by foreign capital

Mirafiori S. A.	100	Fiat Concord S. A.	-	100	100	Building construction	
Roggio Dycasa Auxini Dragados S. A.		a) Dragging Construcciones	-	20	20	a) Dragging	Dragados Construcciones y Dycasa are local firms backed by foreign capital
		b) Dycasa, Dragados y Constr. Arg. S. A.		40	40	b) Constructions	
TECSA, Arg.	100	a) SADE S. A.	-	50	50	a) Public works builders	SADE and Techint S. A. are local firms backed by foreign capital
		b) Techint S. A.		50	50	b) Industrial installations	

Notes:

1/ In 1973, the following also declared themselves to be foreign firms: Huarte S. A. backed by Spanish capital (Huarte y Cía. S. A. held 97.9% of the capital) tendered locally several times; Urbanizadora Catalina S. A. comprising Techint S. A. (50%), Propulsora Siderúrgica (33.33%) and Techint Eng. Co. de Panamá (16.66%) for specific purposes and Vianinni S. A. which no longer had a share in the market but whose paret company still belonged to the corporation which built the Santa Fe-Paraná under-river tunnel. Although they had registered as a foreign firm, they carried out no construction work of any kind during the years 1972-1974.

2/ In 1973 two Italian firms which belonged to the Chaco-Corrients Corporation registered: Imprese Umberto Girola S. P. A. (which belongs to Impregilo) and Ferrocemento Construcciones y Obras Públicas S. P. A. In practice they have operated like direct subsidiaries of their parent companies, including their turnover volumes with theirs.

Table III. 2 Country of Origin of Capital Invested in the Construction Sector

Country of origin	N° of firms	Foreign Capital Share (.) More than 75%	Between 50% and 74. 9%	Between 25% and 49. 9%	Less than 24. 9%
Italy	6	4	-	2	-
U. S. A.	4	3(..)	-	-	-
Germany	4	2	-	-	2
France	4	3(..)	-	-	-
U. S. A. /Italy	2	2	-	-	-
Spain	3	2	-	1	-
Switzerland	2	1	1	-	-
U. S. A. /Denm.	1	1	-	-	-
U. S. A. /Engl.	1	-	-	1	-
Spain/France	1	-	1	-	-
England	1	1	-	-	-
England/Italy	1	1	-	-	-
Israel	1	1	-	-	-
No information	1	-	-	-	-
Total	32	21	2	4	2

(.) Refers to information in the previous table; that is firms operating between 1970 and 1975.

(..) We have no information on one of the firms.

Source: Table III. 1

From Tables III. 1 and III. 2 we can show that the outstanding feature of the foreign firms' presence in the sector is the relative importance at the moment of capital of Italian origin. The volume of sales of these forms, for example, in 1973 amounted to more than half the turnover value registered by all foreign subsidiaries 43/. It is perhaps difficult to find another branch of activity in

43/ In 1972 the turnover of firms with Italian capital involved in building, including those with capital from several countries (Techint and Sade, for instance), represented 68. 5% of the turnover of all foreign subsidiaries established in the local market, while in 1973 the value reached approximately 74. 0%. (Source: Balances and statements made by the firms).

which they have the same degree of importance, despite the fact that there are companies of the size of Fiat, Olivetti of Pirelli Neumáticos established in the country 44/.

The composition of this capital is also different from that observed in the remaining economic sectors. This empirical evidence would lead us to think that the type of foreign capital invested in construction perhaps has a little connection with that involved at the overall level. But if we analyze its historical development we shall reach a different conclusion: we see on the one hand that is has almost always followed the general process of foreign capital investment through its different stages and, on the other, when its structure altered, this always occured because of a change in world market supremacy, without the structure of domestic demand undergoing any significant change. These are the two hypotheses which we shall try to prove by a brief historical description of the development of the foreign firms in the sector.

2. Historical Analysis

If we examine the periods in which the foreign firms were established (Table III. 3), we can establish four quite distinct stages. The first is directly associated with the in flow and expansion of English capital in Argentina and it lasted from the middle of the last century to the beginning of this one. The second starts around 1910 and ends with the confiscation of German capital shortly after the end of the Second World War. The third stage begins about 1947, sees the incorporation of Italian firms and ends in 1955. Finally, the fourth stage, associated with the new in flow of investments starting in the early sixties, apparently ends a decade later, when both the overall in flow of foreign investment and the launching of new large scale public works decrease.

The first stage is associated with the construction of the country's first big public works (railways, ports - particularly that of Buenos Aires - and the first underground railway) largely financed by English loans and built by firms with direct links with foreign financial groups.

44/ J. Sourrouille shows that "in Argentina, Italian capital has a much higher share than its average on the international level. While some cultural reasons can be oposited to explain this situation", he says, "it is clear that four or five companies make up more than 80% of this share and they belong to the group of Fiat, Pirelli, Olivetti and Dalmine". In spite of this, an analysis at the overall level shows that in 1969 Italian capital had a share of approximately 8.8% of all foreign capital in Argentina, while the U.S.A.'s share was 51.2%, England's 15.7%, France's 10.8% and Germany's 9.0%. Juan Sourrouille, El Impacto de las Empresas Transnacionales sobre el Empleo y los Ingresos: El Caso de la Argentina. Programa Mundial del Empleo. Documento de Trabajo. OIT, Geneva, April 1976. pp. 77 and 78.

Table III.3

Year of Establishment of Firms in the Building Sector Backed by Foreign Capital

1910/19	1907	-	Phillip Massey (U.S.A.)
	1911	-	Wayss y Freytag (Germany)
	1918	-	Geopé (Germany)
	1918	-	Thyssen Lametal (Germany)
1920/29	1925	-	Siemens Bauunion (Germany)
	1927	-	Sociedad Comercial del Plata (Switzerland)
	1927	-	F.H. Schmidt S.A. (Germany)
	1927	-	S.A. Compañía General de Construcciones (Germany)
	1928	-	Gruen y Bilfinger (Germany)
	?	-	Christiani y Nielsen (Denmark - U.S.A.)
1930/39	1937	-	Pilotes Franki (Belgium)
	1938	-	Grands Travaux de Marseille (France)
1940/49	1947	-	SADE (U.S.A./Italy)
	1948	-	Techint S.A. (Italy)
	1949	-	Novobra SRL (France)
	1949	-	SCAC Sociedad de Cementos Armados Centrifug. (Italy)
1950/59	1950	-	Panedile S.A. (Italy)
	1951	-	Patentes Toschi S.A. (Italy)
	1952	-	Mellor Godwin S.A. (U.S.A./England)
	1954	-	Sadelco S.A. (U.S.A./Italy)
	1954	-	Supercemento S.A. (Italy)
	1954	-	Kaiser Engineers Int. Inc. (U.S.A.)
	1955	-	Rodio Argentina S.A. (Switzerland)
1960/69	1961	-	A.G. Mc Kee (U.S.A.)
	1961	-	Impresit - Sideco S.A. (Italy)
	1962	-	CBI; Chicago Bridge Iron (U.S.A.)
	1962	-	H.T.A. Hochtieff (Germany)
	1966	-	Austin Sudamericana S.A. (U.S.A.)
	1968	-	DYCASA, Dragados y Construcciones S.A. (Spain)
	1968	-	Solel Boneh's Overseas (Israel)
	1968	-	Impregilo S.A. (Italy)
	1969	-	Acueductos S.A. (Spain)
	?	-	Halliburton Argentina S.A. (U.S.A.)

Source: Author's research.

After a large number of studies undertaken in 1821 when the Rivadavia Government asked the English firm of Hullet & Co. to find a hydraulic engineer, the port of Buenos Aires was built by Thomas Walker and Co., an English builder, contracted directly by Madero Proudfoot & Co., which had been awarded the building concession 45/. This firm was set up in London by Eduardo Madero and comprised a "syndicate of English capitalists with Mr. Proudfoot as their representative (...) with the aim of carrying out the project" 46/ for which they contracted Sir John Hawkshow, Son and Hayter as technical directors, who acted with the approval of Baring Brothers, whose participation (through a loan of 500.000 pounds sterling stemmed from the security of having an English expert as works director 47/. On the basis of these data, then, we can legitimately state that the relations between the financial groups and the building (and engineering) firms was not only direct, but that this was a necessary condition for the financing of the project 48/. Though less clear out, a similar situation occured with the building of the railways. With the exception of the Central Córdoba line, designed by local engineers (Próspero Moneta and the Oficina de Ingenieros Nacionales 49/) and built by Telfener & Co. starting in 1872, the remaining lines were built by English and North American firms 50/ and by the concessionaires themselves, who built a large number of the

45/ Guillermo Madero, Historia del Puerto de Buenos Aires, Bs. As., 1955, pp. 58 and 117. Prior to the award of the job, a number of projects were carried out by both local and foreign engineers, such as J. Coghlan or John F. Bateman. President Sarmiento himself, in a message sent to Congress on 31 st. May, 1896, explained that "there were favourable reports on the plans submitted (by the English engineers Bell and Miller) also from the United States, for the Government had consulted Admiral Charles H. Davis, Commander of United States Forces in the South Atlantic (...) and he had given a frankly favourable opinion and showed his agreement with the reports and plans submitted" (Madero op. cit., p. 76).

46/ Op. cit., p. 74.

47/ Op. cit., pp. 60 and 95.

48/ The same building company (Walker & Co.) was backed financially by the Banco de Londres y Río de la Plata.

49/ Raúl Scalabrini Ortiz, Historia de los Ferrocarriles Argentinos; Editorial Devenir, Buenos Aires, 1957, pp. 184-189.

50/ The Villa María de Córdoba railway was built from 1870 by John Simmons of London; the Central Argentino by Allan Campbell and W. W. Evans from the United States; the Ferrocarril Oeste by W. Brigge of London, financed by the English firm Murrieta and Co. and the Andino and the Transandino by J. Clark. See Scalabrini Ortiz, op. cit., pp. 15, 27, 34, 112 and 138.

of the lines by importing most of the material (chiefly metal) from England. In practice, all these works have been financed by capital from English sources and only the Central Córdoba Line, which initially belonged to the government, was financed by local funds 51/.

This development clearly shows that the English building firms were directly involved in the first large infraestructure works. Their decline in the domestic market coincided with the general challenge to English hegemony over both export-linked transport systems and over the financial system itself 52/.

This process, which began around the beginning of the century, was reflected in the building sector, with the entry of German Capital, a stage initiated around 1910 and characterised by the establishment of Wayss and Freytag A. G., Geopé, Siemens Bauunion and Gruen and Bilfinger of German origin, firms which until the Second World War held a marked supremacy in the domestic market along with Grand Travaux de Marseille, France, the Sociedad Comercial del Plata, with capital of Swiss origin and Christiani and Nielsen of Danish origin. (See Table III 4).

This second wave of establishment of foreign building firms was associated with two processes which strenthened in the twenties: on the one hand, the construction of large public and private works began, the main cities being remodelled by means of new avenues and parks and the building of

---

51/ Scalabrini Ortiz shows that a large part of the funds which financed the building of the railways was obtained from local sources, even though the concessionnaires themselves stated that they had obtained them abroad. What is today a classic point in studies on foreign investment has been studied in Scalabrini Ortiz' work with great clarity.

52/ It is significant that in the sectors in which English capital had established its hegemony, a large proportion of the building requirements were covered by English firms. According to Pedro Skupch "British hegemony over the agricultural export economy was based on an absolute control of the transport system connected with exports (railways, shipping companies), the managment of most of overseas trade and the activities linked with it (banks, insurance, etc) and their alliance with the large landholders of the Humid Pampa". El Deterioro y Fin de la Hegemonía Británica sobre la Economía Argentina 1914-1947 in Estudios sobre los Orígenes del Peronismo/2. Siglo XXI Argentina Editores, Buenos Aires, 1973, p. 15. But its hegemony began to be challenged through the replacement of part of the transport systems (massive introduction of the motor car and road building parallel to the railways, for example) and much more so with the entry of North American and German capital which tended to modify the financial and industrial structure of the country.

Table III.4 Foreign Firms Established between 1900 and 1930

Name of the Firm	Parent Company	Country of Origin	Kind of Activity	Comments
Geopé	Philipp Holzman A.G.	Germany	Construction of buildings, dams, bridges, power plants etc.	
Wayss & Freytag	Wayss und Freyt A.G.	Germany	Architectural and engineering works.	
Grands Travaux de Marseille	Grands Travaux de Marseille	France	Engineering works (mainly ports)	
Gruen y Bilfinger	Gruen und Bilfinger A.G.	Germany	Hydraulic, architectural and road works.	
Phillip Massey Co.	Phillip Massey Co.	U.S.A.	Industrial projects	
Siemens Bauunion	Siemens-Schuckert A.G.	Germany	Architectural and engineering works	In 1939 the Compañía Platense de Construcciones S.A. came into operation
Sociedad Comercial del Plata	Motor Columbus y otros	Switzerland	Architectural works. Furniture Sales	
Thysen Lametal	August Thysen-Hute A.G.	Germany	Fibrocement building	

Note: No information has been obtained on the shareholders of F.H.Schmidt and the Compañía General de Construcciones S.A., directly linked with the German group.

underground railways, public buildings, industrial establishments and basic infraestructure works, which stimulated the process of establishment and setting up of new building firms. On the other hand, the composition of foreign capital in Argentina begins to be modified with the incorporation of new firms of German and North American origin which thus begin to replace capital of English origin 53/.

This process is also repeated on a world scale, where German firms, along with American capital, tend to dominate the electrical industry, the expansionary hub of two syndicates, Siemens Schuckert and A. E. G., which develop as multiple interest companies through a process of capital concentration. This situation is reflected in Argentina by the establishment of subsidiaries of both groups and as early as 1898 A. E. G. set up the Compañía Alemana Transatlántica de Electricidad (CATE) in Buenos Aires, which competed with the English electrical companies. According to Somi this fact "can be explained because at that time Germany was initiating its first world economic offensive. Their electrical industry was more efficient and was highly centralized and Siemens-Schuckert and A. E. G. formed a close alliance" 54/.

53/ This process can be seen fairly clearly in the following table:

Foreign Capital in Argentina

Year	Country of origin			Kind of Investment ⁂ ⁂		
	England %	U. S. A. %	Others %	Railways	Securities	Others
1900	81.0		19.0 ⁂			
1909	65.4	0.9	33.7	1874	1612	1764
1913	59.2	1,2	39.5	2724	1711	3795
1917	58.0	2.5	39.5	2625	1564	3791

Source: CEPAL, El Desarrollo Económico de la Argentina

⁂ In 1900, the information is broken down only into England and others

⁂ ⁂ in millions of 1950 dollars.

54/ Luis Sommi, Los Capitales Alemanes en la Argentina, Editorial Claridad, Buenos Aires, 1945, p. 96.

In the domestic market, the German electrical group began to oust the English firms by entering the urban transport system. The Anglo Argentina company refused to continue with the construction of the underground railway unless there was prior general increase in tram fares. This gap was filled by the German bankers who had established C. H. A. D. O. P. Y. F. in Madrid with the aim of building and running five underground railway lines 55/. In practice, it was the German firms of Siemens-Schuckert, Geopé and Gruen and Bilfinger who entered a dynamic market, enhanced by the strong expansion of public works and by the possibility of their securing all the works belonging to the German group 56/.

Today, of the firms which established themselves in this country before 1930, only the Sociedad Comercial del Plata continues to be directly active in the market. The remining companies ceased activities by decision of their shareholders (Phillip Massey and Grans Travaux de Marseille, for instance) or because they were taken over by the State in 1944 when war was declared on Germany, when "the Argentine Republic ordered the seizure of goods belonging to persons of that nationality settled in our country" 57/. The majority of these firms were later brought under the Dirección Nacional de Industrias del Estado (DINIE) until in 1957, by a decree of the then Provisional Government, their sale at public auction was ordered. Only two of the four German firms subsequently remained in the market (Geopé, under the same name, and Gruen and Bilfinger, as Ohen S. A.), but now backed by local capital.

The third great wave of foreign capital begins immediately after the war, becoming more marked between 1947 and 1950. The apparent void created by the seizure of the German firms was filled by firms of Italian origin, some of which had links with the former dominant groups. General Electric, for example, which set up Sociedad Argentina de Electrificación, SADE, in 1947, already had a financial share in the German electrical group at the beginning of the century. In practice, a world wide electricity trust had been formed, controlled by the German and American groups, in which "General Electric has invested 200 milion dollars in the most important electrical corporation in Germany and lesser quantities in the Osram Electric Corporation" 58/.

55/ Luis Sommi, op. cit., pp. 116-118.

56/ We study part of this subject in Chapeter V, under the point on advantages of foreign capital firms.

57/ Official document on "Venta de Empresas Alemanas". Official publication. Buenos Aires, 1958, p. 1.

58/ "La Prensa" newspaper, 4th September, 1939, Buenos Aires; taken from L. Sommi, op. cit., p. 90.

The defeat of Germany in the Second War halted its group's expansionary process, and General Electric was able to increase its share in the local market, taking over the positions vacated by the German firms. The significant thing about this third stage, which influenced by a new international market division in the post-war period, is that the kind of firms which enter the market are involved in activities similar to those of the confiscated firms. That is, the substitution of firms occurs because of a shift in world market dominance without the local demand structure having changed 59/.

This process of establishment of new firms is also directly associated in Argentina with the development and expansion of the Institute for Industrial Reconstruction (IRI) in Italy. Some of the main firms established in the country between 1947 and 1950 (Techint and Panedile) form part of this mixed private-state Italian group, through their subsidiaries Finsider and Condotte d' Acqua. SADE does so too, because of the share held by General Electric in Ansaldo San Giorgio, an electrical engineering firm belonging to IRI through Finmeccanica 60/.

Three features mark this third stage: first, the substitution of the German group by Italian firms, which tend to expand, among other things, because of the development of IRI after the Second World War; second, because of the financial connections the new firms establish with each other, or in other words, because of their incorporation into the same holding company; and thirdly, because of the continuity in the kind of activities they undertake, which in some cases is

---

59/ It is probable that the conditions operating in Argentina after the Second World War favoured the incorporation of Italian capital. Although we have not obtained any information to corroborate this hypothesis, we believe it may be one of the possible explanations for the relative importance of this capital.

60/ See: The State as Entrepreneur. New Dimensions for Public Enterprise: the IRI State Shareholding Formula. Edited by Stuart Holland. IASP Inc., New York, 1973, especially pp. 106-115. On the formation of groups, see also "Who Owns Whom". Compiled and published by O. W. Roskill and Co. Ltd., U. Edition, 1973.

reflected in financial connections between the confiscated firms and the new group 61/.

Finally, the fourth stage, which begins around 1961, is also characterised by the incorporation of firms following the general process of establishment of foreign capital and the development of new large scale infraestructure works initiated in the sixties. At this time firms specialized in the installation of industrial plant (A.G. McKee, Austin, Chicago Bridge and Halliburton Argentina) and companies which have extensive overseas experience in the construction of large public works (Impresit, Impregilo, Hochtieff, Dycasa and Dywidag) join the market.

The special feature of this fourth stage lies in the marked division in the origin of the capital of the new firms. Those which build industrial plant are

---

61/ At the local level, the establishment of Italian firms caused radically different reactions in different chambers of commerce or business groups. For example, in June, 1948, the Argentine Chamber of Builders published an editorial in their magazine Construcciones N° 37, expressing their opposition to the entry of the new firms: " Some time ago, a number of foreign construction firms began to arrive in this country, or to negotiate to come here, probably encouraged to do so by the favourable prospects offered by the numerous plans for public works prepared by the National and Provincial Governments. At that time the difficulties encountered by the construction industry in its attempts to deal with excessive demand were already avident. These difficulties, as is common knowledge, had their origin in the war years, during which machinery which had been worked to its limit had not been replaced or even moderately maintained, and when the economic situation of the Argentine firms, which were on the brink of disaster, would not have allowed the acquisition of the necessary machinery and tools, even if they had been available on the market (...) The situation cannot be remedied by the timely arrival of a number of foreign companies, however capable they are and however complete their transfer here (...) What is unfortunate is that several public departments, without examining the problem in detail and failing to understand the fundamental causes, considered the arrival of these new firms as the panacea for all their ills and hastly granted with conditions of a generosity far removed from those which were a short time before basic requirements for local builders". Taken from Revista Construcciones N° 37, June 1948, Buenos Aires, pp. 713 and 714.

On the other hand, the cement manufactures in 1947 expressed their satisfaction, through the president of the Argentine Portland Cement Institute, at the incorporation of the new firms, since, he said, "the effective and progressive substitution of metal structures by those made of reinforced concrete is beginning". 1st Concrete Conference, 7th-18th November, 1947, Portland Cement N° 14, February 1948, Buenos Aires, p. 3.

all of American origin, while those involved in the construction of public works are of European origin 62/. There is therefore a direct relation between part of the capital invested in construction in this period and the overall flow of foreign capital which is directed mainly to the industrial sector. The opening of a new market (the construction of industrial plant for the new foreign firms as a minimum market) appears as an element favourable to the establishment of firms specialized in industrial construction and whose origin - American - is the same as that of the capital which enters the remaining areas. It is thus quite clear that the construction sector follows the general process of foreign capital investment, and that from 1961 a similar process occurs with American firms, although on a smaller scale, as that initiated at the beginning of the century with the German firms 63/. On the other hand, the entry into the market of the large infrastructure works inaugurated in the sixties, because of their technical characteristics, volume and conditions of finance 63/, favoured the entry of new foreign firms of which the majority had direct links with the groups which had done so between 1947 and 1950.

To sum up, the process began by the English firms with the construction of the first large public works shows that in the four different stages the main foreign contractors have been directly linked with the multinational groups which dominated the overall flow of investment and the financial and industrial structure. When the sources of capital changed, the new supply structure reflected the same kind of dominant trend as that which existed in the world market.

3. How Multinational Corporations have penetrated the Local Market.

Theories of the development and expansion of multinational corporations attempt to explain both the ways in which foreign capital penetrates local markets, and the reasons why a corporation employs a particular strategy. Various authors have shown that a firm can expand its activities overseas along three relatively different lines. The first one is by direct capital investment in a newly formed or by acquiring the ownership and contro of an already established one, but in both cases setting up a legally dependent

---

62/ In 1954 Kaise Engineers Inc., based on American capital, was established to construct the industrial plant of Industrias Kaiser Argentina. It is perhaps the first builder of industrial plant of American origin to be established at the same time as the new inflow of foreign capital, although the process becomes more marked after 1960.

63/ These points are developed more fully in Chapters IV and V.

subsidiary. A second procedure consists of expansion by the technological licensing of their products, processes or trademarks, to firms with whom they have no kind of shareholding connections; and a third way is through the export or their products 64/.

The special nature of the construction sector product allows the expansion of a multinational corporation only along the first two lines. Those who currently have a share in the domestic market have in practice followed six specific strategies (which correspond to the procedures we have just described) (Table III. 5), timing their entry according to both the need and expansionary capacity of the international corporation as a whole, and to the specific nature of local demand.

The strategy adopted by most of the multinational corporations in order to enter the local market was direct investment. None of them expanded by acquiring local firms; rather, in all cases they invested in the setting up of a new firm. This occured both through the expansion of foreign firms already established in the industrial sector, and through the direct establishment of groups which had had no previous interests in the local market. The first category included four of the main firms in the sector (SADE, Impresit Sideco, Impregilo 65/ and Mellor Goodwin), while the second covers fourteen firms with varied performances. (See Appendix II of Chapter II).

In the case of the expansion of already established firms, market knowledge and the ability to achieve vertical linkage assured the subsidiary of important shares in the domestic market, a situation comparable to that affecting the first German firms. However, in practice, not all direct investments succeeded in capturing significant shares of the market, unless they had previously invested capital in other sectors. Nevertheless, eight of the fourteen subsidiaries currently have contracting capacity values which place them among the first thirty firms in the sector.

64/ See, for example, R. Caves, International Corporations: The Industrial Economics of Foreign Investment, Económica, London, 1971; Daniel Chudnovsky, Empresas Multinacionales y Ganancias Monopólicas, Siglo XXI, Buenos Aires, 1974, pp. 23-33; Report of the United States Senate Finance Committee, Impacto de las Empresas Multinacionales. I. Tecnología y Finanzas. Ediciones Periferia, Buenos Aires, 1975, pp. 40, 99 and 118, and Stephen Hymer, Empresas Multinacionales: La Internacionalización del Capital. Ediciones Periferia, 1972, Buenos Aires, pp. 21-24.

65/ We include Impregilo in this group because of its direct shareholding links with Fiat SPA and Impresit-Sideco.

A second way of getting into the domestic market is by foreign builders granting technological licenses to local firms 66/. The different character of each kind of project or of each specific construction, means that contracts for technical assistance applying to all the projects carried out by a firm are not normally possible. A multinational corporation which attempts to expand its activities into the local market through the licensing of its construction processes can do so only by granting technical assistance for a specific project, unless it licenses a process or product which forms part of the input for a particular type of project. This is the case with Dywidag and STUP, which enter the domestic market in order to exploit the technological advantages arising from a process which forms part of the input of bridge construction, but which does not involve complete technical assistance for the firm undertaking the construction. In manufacturing, the nature of the products and the need, in some cases, to license technical assistance for complete manufacturing processes, allows a permanent license to be granted for all a company's sales. On the other hand, in the construction sector, the diversity of the projects carried out by a given firm and the difference in complexity of each construction makes foreign technical assistance necessary only in those cases in which local capacity does not cover the minimum specifications of a project. In this respect, a multinational corporation has very limited possibilities of using the licensing of its processes or trademarks as a strategy for market penetration. This difficulty is reflected in Table III. 5 where we note the limited number of corporations which license processes in relation to the firms which enter the market through direct investment.

Finally, exporting as a strategy of market penetration may resemble the temporary investment of capital in order to carry out only one specific project. This form of market entry apparently does not allow a corporation to establish its product, trademark or production process, as usually happens in the manufacturing sector, because the corporation is established only to carry out a single project which, due to its special characteristics and individual specifications, differs substantially from all other constructions. More precisely: it does not introduce a product on a large scale, but rather builds a "unique", non-standard construction, which reduces its possibilities for continuity. Nevertheless, temporary capital investment is the form of market penetration most akin to direct exporting.

In the local market, the firms which have employed this strategy are basically companies which in their countries of origin have direct links with the parent companies of local subsidiaries. This is the case with Girola and Ferrocemento which are linked to the groups controlling Impresit and Impregilo. But both this strategy and technological licensing are of little relevance to an

---

66/ In Chapter IX we develop more fully the subject of technological licensing.

Table III.5 Foreign Subsidiaries' Strategies
for Entry to the Local Market
(Firms established in 1973)

Market Entry Strategy	Company	Comments
Direct investment, without the parent company's having had any previous interests in the local market.	★ A. Christiani y Nielsen S.A. ★ Arthur G. Mc Kee Co. ★ Austin Sudamericana S.A. ★ Chicago Bridge & Iron Co. ★ Dragados y Constr. S.A. ★ Field Argentina S.A. ★ Hochtieff A.G. S.A. ★ Novobra S.R.L. ★ Panedile Argentina S.A. ★ Rodio Argentina S.A. ★ Solel Boneh's S.A. ★ Spooner del Plata S.A. ★ Supercemento S.A. ★ Techint S.A.	A number of industrial and financial firms were set up at the same time as the construction firm.
Direct investment, after the establishment of the parent company.	★ Impresit-Sideco S.A. ★ Mellor Goodwin S.A. ★ SADE S.A. ★ Impregilo S.A.	
Temporary Investment in order to carry out a specific project	★ Empresa Indiv. H. Girola ★ Ferrocemento Constr. SpA	Involved in the construction of the Chaco-Corrientes Bridge. Belongs to Impregilo. Involved in Chaco-Corrientes Bridge.

Licensing of technology and subsequent establishment.	★ Vianinni S.A.	Prior to its establishment, licensed technology to SCAC.
	★ Dywidag A.G.	Previously licensed technology to Aceros Sima S.A.
Direct investment and subsequent licensing	★ Grands Travaux de Marseille	This firm was established in this country until the forties. Subsequently, a subsidiary of the group, Société d'Etudes et D'Equipement, drew up the plans for the Chaco-Corrientes highway system.
Licensing of technology and direct investment (at the same time)	★Sociedad Comercial del Plata S.A.	One of the subsidiaries of the group which controls SCP, Electro Watt, licensed technical assistance locally for hydroelectric works. La Sociedad Comercial del Plata is involved in the construction and sale of buildings.
	★ Acueductos S.A.	At the same time it was established, it granted invention patents to Jaime B. Coll S.A., a local firm involved in sanitation works construction.
	★ Geosonda, Cimentaciones Especiales S.A.	Its parent company gave technical assistance to Impresit Sideco. The latter also owns 49.5% of the shareholding of Geosonda.
	★ STUP	Markets a technological development carried out by its parent company in the local market.

explanation of the behaviour of multinational corporations in their attempts to capture foreign markets.

Their strategy has been mainly based on direct capital investment, principally because of the conditions imposed by the nature of demand, which in many cases explicitly excludes the use of any other kind of strategy. When there is a call for the construction of a public work, for example, market entry requires that candidates be selected by means of a tender which imposes strict operating conditions on the contracting firm: it must be registered with the public works registers; have a contracting capacity adequate for the volumes of the tender, and only firms already established in the local market can bid, unless the tender is of an international character. In this respect, the special structure of the construction market makes direct capital investment the basic strategy for entering it. In this case, it is valid for practically all foreign firms.

4. Participation in the Building Sector by Firms Backed by Foreign Capital

If we study the construction industry as a whole, we can see that, besides its significant company fragmentation, it shows a relatively small participation by foreign firms. Taking as an indicator the maximum annual contracting value assigned by the public works registers, we can see that in 1975 nineteen foreign subsidiaries controlled 12.6% of this capacity: 67/

	Number of Companies	Percentage of all Companies	Percentage of Total Max. Contract Capacity
Foreign Companies	19	0.4	12.6
Local Companies	4.630	99.6	87.4

Source: Author's estimates using information from balances and from the Registros de Actividades Industriales y de Inversión Extranjera.

67/ It would not be an exaggeration to assume that almost the whole contracting value assigned to foreign firms is concentrated in these 19 subsidiaries, since the remaining 13 firms show a significantly lower value. It has been practically impossible for us to work them out individually, but from their current turnover values it is possible to deduce that the proportion could rise to a little over 15%.

From these figures we can deduce that, although foreign capital has a comparatively low share here in relation to other sectors, the concentration of contracting capacity in a small number of subsidiaries compared to the total number of building firms is significant. The explanation lies partly in the relative position of the foreign contractors within the overall construction market. If, for example, we take as the basis for analysis the period 1963/1968, we can see that foreign firms controlled between 85% and 90% of the total turnover value of the five main firms in the sector; between 65% and 72% of the turnover of the first ten firms and approximately 47% or 48% of the turnover of the first forty firms (Table III.6), which allows the conclusion to be drawn that these subsidiaries have a dominant position in the market, or, expressed in other terms: that the special structure of the branch, which permits the entry of a significant number of firms and so leads to company fragmentation, also has a small number of firms backed by foreign capital which occupy dominant positions, although the 19 firms hold only 12.6% of the maximum contracting capacity.

Table III.6 Share of Building Firms backed by Foreign Capital which are among the Largest Companies in the Sector

Share of the turnover of the firms backed by foreign capital in relation to the total turnover of the	1963	1964	1965	1966	1967	1968
First 5 firms	87.2	84.6	85.2	87.1	59.6	90.5
First 10 firms	64.2	70.7	64.7	65.7	66.8	72.7
First 20 firms	56.1	57.8	55.5	57.4	58.8	50.8
First 40 firms	(*)	47.1	46.9	44.6	46.1	48.2

Source: Author's estimates from information from balance sheets (Appendix II of Chapter II)

(*) No information

5. Connections between the Main International Corporations.

Another feature of the most important foreign firms in the sector is the connection both between their parent companies, and at the local level, through financial relations or links between their boards of directors.

The most important group is the one made up of Italian capital linked through IRI (Instituto para la Reconstrucción Industrial) of Italy, which controls part of the shareholdings of the parent companies of Panedile, Impresit-Sideco, Impregilo and Techint. Also, as we have already seen, SADE forms part of the same group through General Electric shares in Ansaldo San Giorgio and because of Fiat SpA's controlling interest in the Compañía Generale di Electricitá, which holds 49% of the share capital of SADE. Together with the other construction firms which are directly linked through local subsidiaries (Mirafiori, Demaco, Edificadora Continental), the Italian group covers approximately 70% of the total turnover value of the foreign firms, and six of its associated companies are among the fifteen biggest firms in the sector. (See Appendix III. 1)

It is not surprising that a similar situation was observed in the German group, and in a large number of the English firms which carried out infrastructure works 68/. In fact, the foreign firms always grouped together, which enabled them to get well ahead of the local firms and achieve not only greater market stability, but also win contracts for a significant number of large scale public works. (See Appendix III. 2) With the control of a minimum percentage of total construction capacity, they have dominated a section of the market always characterised by works of large volume and relative technical complexity, which shows that their influence is more closely connected with their relative position than with their overall share of the market. Or more precisely, a low relative share does not always reflect marginal importance.

68/ See Luis Somi, op. cit., pp. 210-216 and Scalabrini Ortiz, op. cit., Chapters II, III and IV.

APPENDIX III.1

Participation by Board Members of Impresit Sideco in Firms Connected with the Construction Sector

Name	Firm	Position on Board	Comments
Alfredo Lisdero	- Impresit Sideco S.A.	Chairman	
	- Siemens Argentina S.A.	Director	These make up the Techint group. Santa María S.A. owns part of the share capital of Techint S.A.
	- Dálmine Siderca S.A.	Director	
	- Propulsora Siderúrgica S.A.	Director	
	- Santa María S.A.	Director	
	- Mirafiori Construcciones	Director	
	- Edificios Continetal S.A.	Director	
	- CAMSA Cía. Arg. de Med. S.A.	Chairman	
	- Supercemento S.A.	Member	
	- Fiat Concord	Vice-chairman	
	- Fidemotor S.A. (machinery & engine assistance service)	Director	
	- Loma Negra S.A.	Member	
	- Cía. Constr. El Chocón Impregilo Sollazo S.A.	Member	
	- Inmobiliaria Lamaro Const. S.A.	Member	
	- Geowell S.A. (sub-soil exploration and exploitation)	Member	

Francisco Macri	- Impresit Sideco S. A.	Director	Owns 40% of Impresit's capital
	- Demaco Construcciones S. A.	Chairman	
	- Edificadora Continental S. A.	Vice-Chairman	
	- Polistena Inmobiliaria S. A.	Director	
	- Tutora Cía de Seguros	Director	Is a member of the Board of Tutora Andrés Lastiri Ruiz, which is in turn a member of a group of 5 firms connected with the construction industry.
Antonio Macri	- Impresit -Sideco S. A.	Director	
	- T. C. I. Tec. Cons. Industrializadas	Director	
	- Demaco S. A.	Director	
	- Edificadora Continental S. A.	Director	
Angela Macchi de Afeltra	- Impresit - Sideco S. A.	Member	Angela Macchi de Afeltra and Alfredo Lisdero belong to the Board of approximately 20 limited companies
	- Supercemento S. A.	Director	
	- Mirafiori Constr. S. A.	Member	
	- Fidemotor S. A.	Member	
	- Inmobiliaria Lamaro Cons. S. A.	Director	
	- CAMSA Cía. Arg. de Medidores S. A.	Member	
	- SADE S. A.	Member	
	- F. M. A. S. A. (marble factory).	Member	
José Bernardis	- Impresit Sideco S. A.	Director	
	- Saryca S. A. (metal ceiling factory)	Director	

Participation by Members of SADE and SCAC in Firms Connected with the Building Sector

Name	Firm	Position on Board	Comments
Vittorio Orsi	- SADE S.A.	Director	
	- SCAC (Soc. de Cementos Armados Centrifugados S.A.)	Director	
	- Morsela	Vice-Chairman	
	- Financiera Eléctrica S.A.	Chairman	
Jorge E. Perren	- SADE S.A.	Director	
	- BLOKRET S.A. (artic. pav.)	Chairman	
	- Dragados y Obras Portuarias S.A.	Director	
	- Morsela S.A.	Director	

Cayetano Azzano	-	SCAC S. A.	Chairman
	-	EMA (Electro Mec. Arg. S. A.)	Chairman
	-	Morsela S. A.	Chairman
Alberto Emmer	-	SCAC S. A.	Manager Director
	-	Ceramil S. A. (factory making ceramic articles for construct-tion).	Director
Angela Macchi de Afeltra	-	SADE S. A.	Member
	-	Impresit-Sideco S. A.	Member
	-	Supercemento S. A.	Director
	-	F. M. A. S. A. (Marble factory)	Member
	-	Mirafiori S. A.	Member
	-	Fidemotor S. A.	Member
	-	Inmobiliaria Lamaro Cons. S. A.	Director
	-	CAMSA Cía. Arg. de Medidores S. A.	Member

Note : Leonardo Francisco D. Prati, chairman of the Board of SADE is also Vice-Chairman of Celulosa Argentina

SADE 's Links with the Impresit Group

Aurelio Pecei	-	Indufisa	Chairman	Holds part of SADE's share capital. Fiat SpA holds part of the share capital of Compañía Generale di Electricitá, holdest of SADE's share capital. Fiat, in turn controls Imprese Italiana All' Estero owner of Impresit.
	-	Fiat Concord	Chairman	
	-	Mirafiori Construcciones	Chairman	
	-	Corfin S. A. (finance company)	Chairman	
	-	Olivetti	Chairman	

Source: Limited Companies' Guide. Cámara Argentina de Sociedades Anónimas. Buenos Aires, 1972.

APPENDIX I II. 2.

Public Works Carried Out By Foreign Firms

Construction Work	Type of Construction	Construction Firm	Comments
Superusina de CADE y CIADE (Puerto Nuevo	Thermoelectric power station	GEOPE (Germany)	
Astillero de Río Santiago	Ship building yard	GEOPE	
Banco Hipotecario Nacional	Building construction	GEOPE	
Facultad de Ciencias Médicas	Building construction	GEOPE	
Ministerio de Comercio e Industria	Building construction	GEOPE	
Central Eléctrica de San Nicolás	Thermal power station	GEOPE y Siemens Bauunion	
Edificio Atlas	Building construction	GEOPE	
Obras Viales del Centro de la Prov. de Bs. As.	Roadworks	GEOPE	Year carried out 1940/44
Destilería La Plata	Industrial	Siemens Bauunion	
Central Hidroeléctrica Alvarez Condarco	Hydroelectric	Siemens Bauunion	
Central Hidroeléctrica San Roque	Hydroelectric	Siemens Bauunion	
Central Hidroeléctrica El Nihuil II	Hydroelectric	Siemens Bauunion	reservoir capacity 387.5 Hm^3

Dique Valle de Uco	Hydro	Siemens Bauunion	
Edificio República (telef. del Estado)	Building construction	Siemens Bauunion	
Dique Florentino Ameghino	Hydroelectric power station	Gruen y Bilfinger	
Dique Dulce Stgo. del Estero	Hydro	Gruen y Bilfinger	
Dique Las Pirquitas	Hydro	Gruen y Bilfinger	
Dique y Usina Cruz del Eje	Hydro	Gruen y Bilfinger	reservoir capacity 124Hm^3 (1940-44)
Cloacas Máximas de la Cap. Fed. (Tramos)	Sanitation Works	Grands Travaux de Marseille	
5 lineas del subterráneo de Bs. As.	Transport System	Gruen y Bilfinger GEOPE Siemens Bauunion	
Puerto de Ing. White Bahía Blanca	Port works	Christiani y Nielsen	
Puerto de San Nicolaś (Pto. de la Planta Gral. Savio)	Port Works	Grand Travaux de Marseille	
Primer tramo Av. 9 de Julio, terraplenes y playas subterráneas	Road System	S. A. F. H. Schmidt	
Ministerio de Guerra	Building Construction	S. A. F. H. Schmidt	
Puente Chaco-Corrientes	Road System	Ferrocemento, Impresit SpA; Empresa Umberto Girola; Impresit-Sideco Geosonda; Ing. Lodigiani, Ing. Recchi	
Dique Quebrada de Ullun	Hydro	Panedile	
El Chocón	Hydroelectric	Impregilo Sollazo	800Mwh.

Cerros Colorados	Hydroelectric	Dragados y Cons. Dycasa Auxini Benito Roggio (Local)
Salto Grande	Hydroelectric	Impregilo Sollazo
Puente Fray Bentos Puerto Unzué	Road System	Dyckerhoff und Widman; Hochtieff; SADE; Entrecanales y Tavora
Puente Zárate- Brazo Largo	Road System	Techint Albano (local)
Túnel Subfluvial Santa Fé-Paraná	Road system	Hochtieff Vianinni SpA
Dique de Embalse Río Hondo	Hydroelectric	Panedile S. A.
Líneas de Alta Tensión Salta, Campo Santo, Paraná, Santa Fé	Electromecha- nical	Elina S. A.
Escolleras del Puer- to de Mar del Plata	Port works	Christiani y Nielsen
Central Nuclear de Atucha	Power	Obras Civiles : Hochtieff, Impre- sit-Sideco, Fiat Concord Central : Siemens AG
Puente sobre La- guna Setubal (Sta. Fé)	Road System	Christiani y Nielsen
Puente sobre Río Colón-Curá (Neu- quén)	Road System	Christiani y Nielsen
Puente Cruce Gral. Paz y Avda. Los Constituyentes	Road System	SADE
Cloacas máximas (Berazategui)	Sanitation works	Supercemento S. A. Vianini Lavori Maritimi SpA

Río Subterráneo Cap. Fed. -Lanus	Sanitation Works	Supercemento S. A. Vianini SpA EACA (local) GEOPE	
Establecimiento depurador Sudoeste La Matanza (Bs. As.)	Sanitation Works	SADE Hidrosudargentina	
Establecimiento de Potabilización (Cap. Fed.) Ampliación	Sanitation Works	Degremont S. A . Christiani y Nielsen	
Sistemas de Riego (Prov. de San Juan	Irrigation systems	Demaco	
Central Agua de Toro	Hydroelectric	Panedile	
Puente sobre Río Guachipas (Salta)	Road System	Panedile	
Estación elevadora de agua cruda (Sn. Martín, Bs. As.)	Sanitation works	Impresit-Sideco Supercemento S. A.	
Av. de circunvalación y acceso a la ciudad de Santa Fé	Road works	Christiani y Nielsen Pilotes Franki S. A.	
Central Termoeléctrica Altos Hornos Zapla (ampliación)	Power	SADE	
Tomas de agua en el Río de la Plata	Water supply	Impresit-Sideco Supercemento; Vianini Draggagi Lavori Marittimi	1974/75
Elevador terminal de granos en el puerto de Ing. White	Grain elevators	Impresit-Sideco	
Líneas Alta Tensión El Nihuil II	Electromechanic Works	SADE-SCAC	

Dique Las Maderas (Jujuy)	Electromechanic Works	Dragados y Construcciones (Dycasa) Petersen Thiele y Cruz S. A.
Acueducto Ciudad de Comodoro Rivadavia	Water distribution	Vianini SpA Supercemento S. A.
Andenes de la Línea Retiro-Tigre, Ferrocarril Bartolomé Mitre	Civil engineering and railway works	SADE-SCAC

Chapter IV. Submarkets in the Construction Industry

One of the problem which quite frequently occur in sector studies when the analysis focusses on variables such as the degree of company concentration, the level of foreign capital participation and the kind of entry barriers which exist is the definition of the universe to be studied. It is usually observed that within a particular "industry" several sectors of activity are juxtaposed, according to whether the aggregate is based on the origin or the destination of the product. This is evident, for example, when we study a large number of papers on industrial concentration, or when we analyze definitions of manufacturing industries. Some of these have tended to group together products which, although belonging to different markets, are manufactured by similar processes and with similar raw materials 69/. In practice, it is a question here of classifications which define the universe of an industry in relation to the components of the production process. Other interpretations, on the other hand, consider that an industry or some branch of it is made of a group of products which are close substitutes to buyers, available to a common group of buyers, and are relatively distant substitutes for all products not included in the industry 70/. That is, the demand component tends to be given predominance over the technical characteristics of the supply of goods.

If we accept the latter classification as valid, we can, in this case, break down the construction industry into submarkets including activities which cover other requirements. Or in other words, it is possible to include within the universe of the industry all those activities which are related in terms of their production process but which can also be divided into individual sub-markets when we analyze them from the point of view of market homogeneity or the degree to which the finished products are interchangeable. On this basis, we have defined seven sub-markets which cover a large part of construction services: 1) building construction; 2) road construction; 3) urban paving; 4) railway construction; 5) industrial construction; 6) electro-mechanical construction 71/; and 7) sanitation works construction.

69/ This is the case with glass, for example, since in the same branch classifications include all manufacturers, whatever their products are used for. In this way different products, such as building glass and domestic fittings and appliances made of glass are goruped together. In this case, of course, the criterion used to link markets is the origin of the products.

70/ J. Bain; Industrial Organization; John Wiley & Sons Inc., U.S.A., 1964 p. 110

71/ We include in this sub-market works involved in the generation and distribution of electricity, including hydroelectric dams, tranformes plants and street lighting. Thatis, we group the elements on the basis of what may resemble a market criterion.

A. Overall Variables

In each of the sub-markets, both supply and demand have special structures, since they respond to variables with different behaviors. Each sub-market, for example, has its own demand function, the reasons for which depend, among other things on the origin of the customer: whether public institution or private agent; on the final use of the product: if it is for individual or collective use, or whether it is part of a commercial investment or for family use; on the restrictions pertaining to each kind of customer: inflexibility in policy regarding public spending, income structure or voulme of private investment; and, at a more abstract level, on the overall economic surplus. In one or other sub-market the demand function variables differ or have a di - fferent proportionate weighting depending on the nature of the product.

This break- down does not, however, mean that we should study each sub-market in isolation since there are connections between them and thus the demand for a particular construction service depends, among other factors, on the volumes of work carried out in sub-markets which absorb their finished product. A certain percentage of sanitation works or urban paving is subject to the volumes and characteristics of building construction: this demand, in those cases, becomes a function of the volume of work carried out in other sub-markets which involve those services.

On the other hand, supply also has its own different structures for each sub-market. Generally speaking, there is a direct correlation between the degree of concentration in each one and: 1) the minimum volumes of construction; 2) the ratio of equipment to labour employed (which depends on both the quality of machinery and the amount of equipment employed); 3) the degree to which equipment has a specific use (or, in other words, the limits on its capacity for use in different kinds of construction); 4) the technical complexity of the construction process itself; and 5) the capacity to take advantage of scale economies. There is an inverse correlation with regard to the possibility of subcontracting specific jobs. Considered from another point of view, the degree of concentration is lower in those activities in which the firm can act more efficiently simply as a coordinator or technical supervisor.

These elements, which may of may not constitute entry barriers to new firms or hinder the mobility of those already established, usually arise from conditions imposed by demand itself of by the specific characteristics of the product, and not because of the conditions inherent in each individual firm 72/.

72/ Of course, the firms' advantages arise from their ability to overcome this kind of barrier. This is the fundamental division between this chapter and the following one, since in this one we shall analyze the structure of each sub-market, emphasising the kind of entry barriers or conditions, while in the following one we shall analyze the advantages at company level.

Thus, the minimum work volumes, for example, act as an entry barrier through the specifications laid down by the Contractors' Registers for each firm. On the basis of weighting which take into consideration, among other elements, previous turnover volumes equipment endowment and staff qualifications, the firms have a maximum possible volume of construction work they can carry out per year, which for public tenders cannot be exceeded. But as it is a coefficient weighted by past production, the expansion of each firm reaches a ceiling because it is obliged to adhere to volumes and kinds of construction works which are laid down for it and regulated a priori, (always on the basis of its historical performance). This kind of legal obstacle naturally affects the supply structure because it stratifies the market according to the affective contracting capacity achieved by each firm. A stratification which has a parallel in the different minimum work volumes demanded by each kind of construction. The bigger the minimum dimension required, the smaller the number of firms legally entitled to carry out the work and vice versa. For example: the construction of hydroelectric complexes or large scale road systems demand very high work volumes which can only be carried out by firms which, according to the Register specifications, have an annual building capacity level directly related to the total cost of the construction.

The foregoing is also affected by the extent to which each construction work has certain specific or individual features, since, in the construction of large public works, tenders are usually called for a kind of product not carried out in an identical way before, which makes entry into the "new" market occur not through competition between all the established procedures but only between some of them - large local and multinational firms which comply with the technical and economic specifications set out in the tender. Nor is quoting the lowest price always a sufficient condition for the tender to be accepted: the number of similar construction works the firm has previously carried out (experience) also affects the situation. Or, in other words, previous experience or performance is an advantage which helps to overcome the barrier arising from a legal condition.

On the other hand, in building construction or in urban structure works (paving, sanitation works or lighting) the work volumes demanded are, in most cases, small, and the customer (a large proportion of this kind of construction is contracted by private persons) does not demand the effective building capacity required by works contracted by public institutions, even though the majority are equally individual works.

In both cases, it can be seen that the demand for construction services involves an implicit requirement for proved company capability, but this differs according to who the customer is and the minimum possible work volumes. The entry barrier is established in these cases by the minimum construction scale and this, in turn, together with the capacity values, serves to consolidate the position of the dominant firms. Since they have high annual levels of construction capacity, they can permanently carry out large scale works and thus achieve

contracting values for future tax years which will allow them to carry out larger and larger works. That is, the relative position of firms tends to consolidate, since those with a high turnover level maintain dominant positions, while the small firms continue to repeat the same turnover value because they are restricted by a low construction capacity level. It is natural that this should produce strong barriers to "upwards" company mobility, that is towards the execution of works of a higher unitary volume; and should thus stratify the market (at the aggregate level) along a very clear horizontal lines. These barriers reduce the capacity of some firms to carry out any kind of construction work, and make the works portfolios of the larger firms easily interchangeable, unlike those of the smaller firms. As we can see, mobility depends on the size of the firms.

A second element which influences company structure is the technology required to carry out a construction work. The construction processes employed in the different sub-markets differ in two aspects: first, with regard to the equipment labour ratio, and secondly, with regard to the minimum equipment required for each kind of construction. Thus, for example, the capital-labour ratio required for roadworks is significantly higher than that used in traditional building construction processes or in some parts of sanitation works. In both cases factor substitution is possible, although the minimum technical equipment required for the execution of a work acts as a limiting factor 73/. But as this minimum level differs in absolute terms for each submarket, there tends to be a stratification of firms here too, since equipment endowment is one of the variables which defines a company"s building capacity, and therefore, the size of the market it can appropriate.

In this respect, there is a direct relation between the minimum equipment demanded in a bubmarket and its degree of economic concentration. In manufacturing industry a similar situation can be observed: the minimum dimension

---

73/ In most cases the tender specifications for a public work define the level and kind of equipment required with considerable precision. For example, for the construction of the Garín Campana stretch of National Highway N° 9, it is stated that: "the contracting company must have the necessary and sufficient equipment for the kind and category of the planned project. The specifications should limit the building options and clearly establish that the bid must contain a detailed description of the equipment and personnel the Company will employ to carry out the work involved in the selected process. To this effect, d details shall be given of their make, production capacity and model, together with photographs of them all. Prior to the adjudication of the projects, the Managment will check the existence and availability of all the proposed equipment, and with regard to cement production preference will be given to automatic or semi-automatic plants which allow precise control operations, thus reducing the operator error rate". Taken from: "Control de Calidad del Hormigón de Calzada de la Obra Ruta Nacional N° 9. Tramo Garín Campana. Primera Sección". Carried out by Engineers José Domnicz and Leonardo Zitzer. Carreteras N£ 69, January-March, 1974, p. 23.

of a plant is one of the determining factors in the degree of concentration 74/. The greater the possibility of substituting labour for equipment, the greater the probability of new firms entering the market, since the minimum level of capital required is low. In the case of the construction industry, this produces a fragmented company structure in those sub-markets in which projects are not highly capital intensive; this situation is characteristic in housing construction (both single and multiple family units), or urban drainage systems, lighting, or urban paving (although for the latter the necessary equipment endowment is greater than for the previous ones). On the other hand, for all other projects the requirements are greater, because the minimum plant scales vary and may be defined by the technical specifications of the building processes themselves.

This direct relation between work volumes and minimum equipment endowment concentrates the supply structure since it produces strong entry barriers for execution of large scale works. Or, from another point of view, it can be said that a technical change arising from the introduction of new equipment can also affect the entry of new firms 75/.

Finally, in this outline of the factors which influence the supply structure, there is another entry barrier reflected by a direct relation between the technical complexity of construction work and its total value. This does not imply that every large scale work always involves technical complexities, because a block of flats is easy to build, even though it involves high total turnover values. On the other hand, all technically complex projects involve high aggrega-

---

74/ Meir Merhav suggests that in the industrial sector, the transfer of advanced technology to an economy with a low aggregate demand, the disparity between the scales of production to which the technology is adjusted, and the size of markets, produces an industrial structure dominated by monopolies which are technically inevitable (M. Merhav, op. cit. p. 20). It is unlikely that this would occur in the construction industry, since generally speaking each work (or product) demands a different combination of equipment Technology becomes a mere joining of parts (machines) which can be achieved by a single firm or by the temporary fusion of two or more firms (Joint Venture). That is: such transfer is unlikely to produce a monopoly structure, although higher demands for equipment produce an entry barrier which may (and in fact does) end in a oligopolic structure.

75/ According to Sylos Labini "If the new installation, or the new machine, is accesible to all firms, whatever their size, then in the short term also, cost reduction is general and the equilibrium price will tend to fall. But if the new installation is accesible only to the large companies, this does not occur; the price remains unchanged and cost reductions affect only these firms which thus receive a higher profit than before". Sylos Labini, op. cit., pp. 80 and 81.

te costs, which produces two situations: First, since the aggregate value of the works are high, the number of firms able to undertake them is limited, if public works are referred to, of course, since, as we have already seen, entry to this market is limited by the company capacity values fixed by the contractor registers); second, company size and organization vary according to the degree of complexity of a work. This occurs because every work requires special study since in general there are no two constructions alike 76/. When the technological level required is high, the firm carrying out the study must organize a technical department to work out the work programmes, which naturally affects the kind of company organization. The construction of dams or complex road systems requires the preparation of extensive special studies, unlike the construction of dwellings or minor urban infra structure works which do not require the setting up of engineering departments. These different levels indicate a direct relation between company size and organization and the technical complexity of a project, which may be expressed as technical and organizational irregularities.

In manufacturing industry, technical complexity is reflected in the plant structure itself, and any technical problems involved in the finished product have been reasonably well solved after the first few commercial launchings. On the other hand, in the construction industry, the individual nature of each product requires a specific study for each work and this is what makes it possible for the technical characteristics of the finished product to dictate the kind of firms which may enter the market.

We have so far analyzed the overall variables which affect the supply structure, taking into consideration basically those which arise from the intrinsic nature of the product and those created by the kind of demand in the sector. Using this framewokr we shall try, below, to analyze the variables which define the structure of each sub-market. In order to do this, we shall study company behaviour both in building construction and in electromechanical, road and sanitation works.

B. Analysis by Kind of Construction Work

1. Building Construction 76 a/

In Chapter I we described the special characteristics of the demand for buildings - its fragmentation and geographic spread - affect the supply structure,

---

76/ As long as large scale programmes involving repetition of the same structure are not carried out.

76 a/ This category includes dwellings, offices and other non-industrial buildings.

by causing the formation of as many productive units as there are works under construction. Little technical equipment is required for each work and minimum-optimum plant scales do not constitute an entry barrier for firms 77/. The latter act basically as coordinators and supervisors of a large number of jobs (cementing, masonry, carpentry, etc.) which are carried out by units independent of the contracting company which usually provide their own equipment 78/. It is unlikely that in such a special situation a firm will be able to internalize scale economies which will allow it to modify the supply structure. On the other hand, the physical situation in which most building construction is carried out also affects the kind of technology and, therefore, the equipment which can be used. The physical space available for a building work between dividing walls (single or multiple family housing), for example, prevents the use of heavy equipment, which requires a larger space than that traditionally available on a site based on the Spanish division into dameros. Only prefabricated "parts assembly" can be carried out, using labour-intensive processes, which naturally reduces the need to set up workshops requiring a large initial capital stock.

This situation allows non-complex company organizations to enter the market, since technical experience and the knowledge necessary to maintain acceptable standards of quality can be achievved by small of family firms. Scale economies do not give established firms any advantage and allow new builders to enter on an equal footing as far as winning building contracts is concerned. In this respect, technical and organizational demands do not restrict the entry of new firms. The principal barrier is the capacity to gain access to financial sources, since the basic restriction involves the amount of finance required by a firm to deal with the different stages of its construction works. The share of the market it may obtain is a direct function of its own funds or of its connections with the different credit institutions. . If it obtains permanent finance, it can either undertake significant volumes of work, subcontracting jobs to third parties, or it can invest only in simple items of equipment, but without necessarily setting up a permanent company organization. This allows a rapid creation and dispersal of firms which, together with the kind of demand, produces a fragmented structure with small units of production.

These characteristics mean that the typical firms in this sub-market are only able to carry out building construction, since larger scale works require a significantly different kind of organization and equipment endowment. On the

---

77/ CFI. Consejo Federal de Inversiones, Bases para una Política Nacional de Vivienda. Buenos Aires, 1964.

78/ Returning to Chapter I, this implies that the construction process links completely unconnected organizations and the construction firm acts as the unifying agent of divergent elements.

other hand, the firms which specialize in engineering can, at times when demand is low, enter the building market and thus minimize the idle capacity of their fixed capital. However, although the two kinds of firms have a different technical and organizational structure, blocks of flats can be built equally efficiently by a small firm (comprising only one specialized technician) or by a building firm which gives preference to engineering work. If they have equal access to finance, technically they can operate with the same efficiency, since in order to carry out a work they only require technologies which are commonly known in the market, and which can be applied by both kinds of firm. That is, technically, building construction allows the formation of small units which are not at a disadvantage - in their area - with respect to the relatively larger firms. However, their financial limitations and their ability to move from one sub-market to another, usually place them at a disadvantage in relation to credit institutions, which basically play the role of intermediary between the final customer and the builder 79/.

In a market structure like the one described, it is to be expected that foreign capital firms do not find participation advatageous, given that they cannot take advantage of apparent scale economies which would arise from their plant size, nor act independently, because their role would imply subordination to the finance groups 80/.

To sum up, this kind of situation produces the following basic sub-market characteristics:

1) There is significant company fragmentation since the relatively largest firm controls approximately 1.7% of the total contracting capacity value, while the four largest control only 6.6% of the total. These figures are proof of limited company concentration, comparable to that prevailing in branches such as carpentry or brick manufacture, etc. 81/.

79/ One of the specail points regarding this situation arises from the fact that during the construction process the firm has no control over the final product, since it always belongs to the credit institution, which makes an enormous profit when it puts it on the market. This is a typical situation in all "order" industries, and it sets them clearly apart from most branches of manufacturing, in which the manufacturer has "control" over his product till the moment it is launched on totthe market.

80/ The connections between construction and financial groups will be studied in Chapter V, as a possible market advantage.

81/ Several authors; El Desarrollo Industrial en la Argentina; op. cit., pp. 58 and 59.

2) This company fragmentation also reflects the predominance of local firms firmly established in a market in which technological demands are fairly limited.

3) The firms with the highest growth rate in relation to their turnover volume are those directly or indirectly connected with financial institutions or which have greater access to government programmes 82/.

4) It is hardly feasible for building contractors to shift to other submarkets, given that they are limited by the kind of company organization and equipment available to them. On the other hand, a shift in the opposite direction - of engineering firms into building construction - is relatively simpler, despite underutilization of equipment. This produces greater instability for building contractors, as they lack an organization which allows them to adjust to demand fluctuations 83/.

5) Large foreign capital firms concentrate on the construction of public works (engineering) and have only a marginal share in the building construction 84/.

82/ We shall examine this point more fully in Chapters V and VI.

83/ Cassimatis reaches a similar conclusion for the United States, when he demonstrates a high rate of movement in and out of the market for small firms.

84/ The foreign subsidiaries we have found making inroads into this submarket are:

a) Dycasa S. A., which, after building the Los Molinos Dam in Jujuy, became involved in government housing plans and began to undertake the construcion of commercial buildings;

b) Demaco Construcciones (connected with Fiat group);

c) Field Argentina, which builds only blocks of flats, having built some with their own finance (Parque Field de Rosario);

d) Impresit-Sideco, which carries out building construction as a marginal activity;

e) Panedile Argentina, whose participation in building construction is marginal;

f) Sihl S. A., which builds prefabricated housing, jointly with Viviendas Condal and Vivienda El Gaucho;

g) Solel Boneh's, which built housing complexes according to the plans of the Municipal Housing Commission;

h) Sociedad Comercial del Plata, which links a group of building and finance companies and is mainly involved in building construction; and

i) Supercemento, which carries out sanitation works and build blocks of flats in according with government plans.

2. Electromechanical Works

In this sub-market we can clearly distinguish three kinds of works linked through their function: the generation and distribution of electricity. In practice, these are:

a) power stations (hydro or thermo 85/);
b) high tension cables and distribution exchanges; and
c) secondary distribution works and laying of lighting networks.

The differences between them are, of course, reflected in terms of their minimum work volumes, their technology and the basic equipment they require. This allows the sub-market to be divided into two clearly differentiated areas which group together on the one hand secondary distribution networks and on the other basic energy generation and distribution works.

These differences allow us to postulate a priori that behavior and company structure will also differ according to whether we are considering the firms which carry out works included in points a) and b) or those in point c). If we take as an example the firms which carry out secondary distribution and lighting, we shall observe that they are organized on the basis of a product which requires no previous complex study and the construction of which is usually carried out using technologies freely available in the market. Technological progress is slow and in practice there are no important changes in construction processes. Modifications arise basically from the inputs employed, which prevents the technological component from acting as an entry barrier; the same applies to the minimum equipment required. For this reason, the firms employed in this kind of construction work can be small, with a minimum fixed capital comprising minor equipment, and a company organization based on the work of independent specialists. This situation creates a fragmented supply structure, in which most of the firms reach a limited annual turnover volume, which is similar for each of them. Unlike the situation in building construction, job subcontracting is of marginal importance here. If a company subcontracted part of the work, it would

---

Although this is a long list, since it includes nine foreign capital firms, their actual participation is not relevant: only four of them are housing specialists (Field, Sihl, S. C. del Plata and Solel Boneh's), while the remainder carry out building construction only on a temporary basis. The turnover of Panedile or Impresit, for example, represents only 1%.

85/ Atomic power stations can also be taken into consideration (Atucha-Río Tercero), although their weight in relation to the total is insignificant.

practically cease to operate, since lighting and secondary distribution works do not involve different stages. Firms carry out the whole construction, and only subcontract labor when the work requires it; although they rarely act in a supervisory or coordinating capacity like the building construction companies 86/. On the contrary, in the construction of electrical power stations, high tension cables and distribution exchanges, the company organization and technology employed involve a larger scale and greater complexity, since they are directly related to work volumes of considerable size. To carry out a project, a firm must have both the technical and the organizational capacity corresponding to the cost estimates for the job, and only those firms can undertake it whose theoretical contracting volumes are based on previous similar experiences. For this reason, their previous performance and their equipment and specialist staff endowment determine their possibilities of entering the market or, in other words, the minimum technical requirements and company size required act as an entry barrier, since a firm must adjust to minimum work and equipment volumes or technical demands, feasible only for large scale firms. Therefore a clear division can be observed in the sub-market, between firms equipped to construct only secondary networks, and those which can undertake the construction of high tension cables or distribution exchanges as well. The difference is naturally more marked if we also take into consideration the firms which build power stations 87/.

In this way two dissimilar company structures - with regard to size and degree of complexity - are juxtaposed within the same sub-market; they are

---

86/ In a large number of works, the firms which undertake lighting systems are subcontracted by firms which have obtained a contract for a complete housing project. This situation, which we shall analyze more fully in Chapter VI, can lead to inter-firm monopoly practices, although this naturally varies to the relative position of each firm.

87/ The construction of large hydroelectric works involves extreme demand indivisibility, since a large scale construction is required, which can only be built by a firm capable of meeting these demands. In other sectors, even if demand were as great, if it could be subdivided into small parts, it would permit market fragmentation and firms could learn by doing. Here, entry barriers are created both by the unitary indivisibility of demand and technological progression (greater technological capacity which excludes firms), and the size of the firm in relation to a high demand volume. In this case, the barriers are created in a market in which the customer imposes conditions and the bidder does not have to introduce a new product but demonstrate, through his experience and capabilities, that he is "equipped" to carry out the job.

linked by virtue of the larger firms' ability to interchange different kinds of project within their works portfolio.

The overall structure of this sub-market in 1975 was as follows:

Table IV.1 Economic Concentration

Electro-mechanical works

Share in sub-market	4 largest firms	6 largest firms	8 largest firms	Foreign Firms' Share
	46.3%	56.7%	66.8%	52.3%

Source: Drwan up from capacity values granted by the Contractors' Register.

Of course, the further subdivisions that exist in the sub-market cause these rates of economic concentration to be modified for each kind of project 88/. For the construction of large hydroelectric power stations the market is almost entirely controlled by a small number of firms - basically foreign (Impregilo, Panedile, Hochtieff, and to a lesser extent Dycasa) - ; while Argentine firms have entered the market in association with the main contractors. On the other hand, for the construction of medium-sized or small stations, even though there is still a high rate of concentration, Argentine firms have a relatively larger share.

In practice, this ologopolic structure accentuates even more the entry barriers created by legal factors - maximum contracting values, among others - since the established firms can draw up agreements to divide the market so that they can maintain the current structure from year to year. The same thing happens when accumulated experience is considered as one of the basic elements in the allocation of works; this makes it possible for the entry capacity of new firms to be reduced since they are apparently caught in a vicious circle.

One way of breaking this circle is through joint ventures of firms which, although they do not possess the necessary capacity individually, by forming a group succeed in jointly achieving the capacity values required by the work. In this way a temporary company is formed which, although it is dissolved on completion of the work, allows firms with less capacity access to works of a magnitude greater than their average turnover values 89/. Association thus reduces the entry limitations created by minimum work volumes, although the algebraic sum of contracting capacities does not necessarily lead to the formation of a group able to cover the requirements set out in the tender specifications. Although it is true that by adding capacities together, they can reach the maximum required values, this does not mean that they achieve the technical capacity necessary to carry out the work, since this still corresponds to each individual firm. This is reflected more clearly, of course, in large engineering works, but has less weight in less technically

---

88/ it we take the sub-market overall, the relatively most important firm is SADE, which holds 16.3% of the maximum annual contracting capacity. It is significantly different from the firms which undertake large hydroelectric power stations (which it exceeds in individual capacity value) by the fact that it carries out all kinds of electromechanical works and participates in the remaining sub-markets as well.

89/ The subject of company associations is studied more fully in Chapter VI.

ambitiuos works. In this respect, the sum of capacities is a necessary, but not sufficient, condition to eliminate the entry barriers which arise from differences in the contracting capacity of each firm.

A second way in which medium-sized firms may begin to carry out large scale works is by the re-equipping of a firm according to the requirements of a specific work. With the endorsement of a public institution the company can obtain credit in order to purchase the equipment required to carry out the work, thus increasing its previous technical capacity by modifying one of the variables which determine its maximum turnover values. In this way, it complies with the tender specifications and at the same time gains access to work volumes relatively higher than those of its average turnover. This way of entering the market is of only marginal importance, since a medium-sized company backed by domestic capital has little chance of obtaining finance in the local market and is practically unable to do so abroad. Perhaps Vialco (in the construction of Futaleufú dam) is one of the few examples of this method of overcoming market limitations.

But in practice this kind of mechanism for overcoming entry barriers does not modify the concentrated company structure; the established firms can continue to produce their capacity values and again achieve significant market shares, because they constantly carry out works which place them on the upper capacity scales, a situation in turn accentuated by the nature of the works they carry out: it takes several years to complete them which, in practice, means firms can overcome fluctuations inherent in demand. In this way, a consolidated company structure is formed similar to that of the manufacturing branches which have a high degree of economic concentration.

Generally, in the different industrial branches a direct correlation ca be seen between the level of participation of foreign capital and the degree of economic concentration. This correlation appears, both when the construction industry is analyzed as a whole, and when it is broken down into individual sub-markets. The relation between economic concentration and foreign capital participation does not differ with the structure of each sub-market. In the case of electro-mechanical works, there is a high rate of economic concentration (the 4 largest companies control 46.3% of the market), and there is a significant participation by

foreign capital firms (52.3%) (Table IV.1) 90/. Both features differentiate electro-mechanical works from building construction. These differences also appear in the larger relative size of the "representative firm" than that of the average which operates in the industry as a whole. For example, they show the highest turnover volumes and, in the case of foreign companies, are firms with a significantly higher level of efficiency 91/.

In this respect, it is not difficult to conclude that the predominant feature of the sub-market is the oligopoly. Moreover, as it includes different kinds of works, the level of relative concentration for each one of the strata is polarized or further accentuated 92/.

90/ At the local level, the subsidiaries which are currently carrying out electro-mechanical works are:

- Dycasa, which built medium-size dams.
- Gesiemes, which builds minor works.
- Hochtieff, which has tendered for large scale dams.
- Impregilo, which carries out large scale electromechanical works.
- Impresit-Sideco, which, in association with Impregilo, is involved in large scale works and individually in relatively smaller ones.
- Panedile, which has built medium-sized dams, and has tendered for works with a high unitary cost.
- Pirelli S.A., which is linked with this sub-market through its installations department.
- SADE, which carries out all kinds of electo-mechanical works.
- Techint - Elina, which mainly carry out network laying.

91/ In general, the local subsidiary's share has a relatively low weight in the total sales of its corporation. Juan Sourrouille shows that the share of sales of a local subsidiary in the turnover of the corporation as a whole rarely exceeds 5%. This only occured with the local Fiat company before its establishment in Brazil. For the remaining firms, the sales of those of American origin represented 2%, while among those of European origin the sales of only three subsidiaries (Peugeot, Renault and Pirelli) represented between 2 and 5% of total manufacture. That is, the importance of the local subsidiary, considered individually, is marginal within the corporation. Op. cit., p. 73.

92/ In the following chapter, we shall describe as one of the advantages of the established firms the different kinds of connection the building companies have established with materials and equipment suppliers. Company behaviour naturally differs according among other variables, to the degree of vertical integration of each firm. This is one of the points most clearly seen among the relatively larger companies which operate in the elctro-mechanical submarket.

3. Roadworks and Urban Paving

Roadworks demand a significantly larger equipment endowment than any other type of construction except for hydroelectric power stations. Both road-building and urban paving are technically simple to carry out, and the technological component is inherent in a company's equipment or the expertise of its technical and professional personnel. The first entry barrier is the financial capacity necessary for a company to acquire the equipment required to carry out a project. This restriction makes the entry of new firms less elastic than that observed in building construction or in urban lighting. For this reason, it should not come as a surprise that this sub-market shows very high concentration rates. In 1975, for example, the 16 largest firms controlled rather more than 71% of the total contracting capacity for roadworks (Table IV. 2), which is, of course, a relatively high concentration rate if we take into account that in that year approximately 755 firms with effective contracting capacity

Table IV. 2 Economic Concentration in Roadworks Submarkets 1975

	Share belonging to the 4 largest companies	Share belonging to the 8 largest companies	Share belonging to the 12 largest companies	Share belonging to the 16 largest companies
Share in relation to total capacity assigned	30.2%	49.1%	62.1%	71.7%

Source: Drawn up from contracting values of construction firms.

were registered 93/. In other words, 2% of the companies controlled practically three quarters of the market (Table IV. 3).

Table IV. 3 Relative Concentration

	Share belonging to the 4 largest firms	Share belonging to the 16 largest firms	Share belonging to the 739 remaining firms
Percentage of total number of firms	0. 5	2. 1	97. 9
Percentage share in the market	30. 2	71. 7	28. 3

Source: Id. Table IV. 1 and IV. 2

93/ Asociación Argentina de Carreteras. El Camino y El País. Buenos Aires, 1974, p. 118. It should be noted that this figure refers only to firms in operation and registered along with their background, and with sufficient technical and financial capacity to present national public tenders for the execution of roadworks or engineering works. There are also numerous smaller firms equipped to carry out smaller scale works, either public or private, but which are not registered, since in 1973 it was not necessary to apply to the Register for certificates of competence to carry out public works, if the amount did not exceed $ 300. 000 annual investment. On the other hand, many firms also involved in roadworks operate in the country, register in the Contractor's Registers of the different provinces, and do not operate in national public works; there are also others which always work in the private field, but always in connection with roadworks. Some statistics relating to these registrations enable us to see the number of firms equipped to carry out roadworks throughout the country, a figure which exceed 2. 500.

These values also prove that the level of company concentration is significantly higher here than that shown by industry as a whole (see Tables II.6 and II.8 in Chapter II) and lower only than that of the electro-mechanical sub-market 94/. Such differences are also correlated with different degrees of participation of foreign capital: in 1975, for example, foreign subsidiaries registered 23.1% of the overall conctracting capacity for roadworks. That is, their share was significantly larger than that which they showed in the industry as a whole, but lower than that of the electro-mechanical sub-market.

It is here that we once again observe a direct relation between rates of economic concentration and of participation of foreign capital and the degree of technical complexity of each construction and the minimum equipment levels required for its execution. In roadworks, for example, with the exception of some very special processes related to the execution of higher works of art, relative technical simplicity does not allow building firms to achieve relative advantages arising from dependent technological knowledge. The entry barriers do not arise from technical requirements as such, but from the limitations imposed by the minimum level of equipment required, which allows Argentine firms - which have equal access to the equipment - to compete perfectly well with the multinational subsidiaries. For these reasons the advantages we observed for electro-mechanical firms, because they have built similar works abroad, are not determining factors in roadworks and this partially enables us to explain, the differences in levels of participation by foreign capital in both sub-markets.

Moreover, if we consider that the level of relative concentration (returning to Table IV.3) in practice show the existence of firms with significantly different equipment and technical personnel endowment (this occurs because the information is based on maximum contracting values), it is easy to conclude also that there are firms with different capacities to overcome the entry barriers. This is due to the fact that the sub-market is stratified into three kinds of constructions, which require relatively dissimilar kinds of organizations, such as: a) larger works of art (bridges, tunnels, etc.) b) roadworks a and c) urban paving.

The basic differences lies, of course, between the firms which build bridge or highway systems and those which carry out urban paving. This division does not, of course, imply a closed stratification denying the existence of firms which can equally well carry out either kind of work. But it does mark a division defining areas of specialization to which firms with relatively different contracting capaci-

---

94/ Firms with a relatively higher turnover level have tended to be those involved with electromechanical works, which would show a certain correlation between the degree of concentration and the size of the firms. See appendix II to Chapter II.

ties can have access.

The construction of complex road systems or large scale bridges in the area where these requirements are more rigorous for firms' entry into the market. The very volume of the projects excludes firms with a relatively smaller contracting capacity and requires a significantly larger equipment endowment than other roadworks. The technological component is an inherent part of the overall project and of the systems used as building inputs 95/. In these cases, the difference between the technology which is an essential part of the construction as a whole, and that involved in the input systems lies in the fact that the work is usually planned by the contracting institution, or by the construction firm through its technical personnel, using or creating non-proprietary knowledge. That is: some of the necessary know-how forms an integral part of the technical capacity of the engineering or production departments of the contracting institution or the construction firm itself. On the other hand, the systems are different: they are all proprietary knowledge (property of the firms which own the patents), so that, if the construction firm does not have its own system of does not have a license to use a foreign one, their use involves a commercial transaction 96/. In other words, to the technical complexity of bridge building is added a dependent market with regard to construction systems, which are necessary inputs of the project as a whole. This situation can be (and in fact is) reflected in defferential advantages among firms, according to their engineering capacity or their ability to gain access to propietary knowledge controlled by the owners of the patent. In road construction, on the other hand, there is no technological restriction connected with the equipment requirements. The basic limitation lies in the composition and volume of the fixed capital, which in practice determines the possibility of market entry 97/.

95/ An example is prestressed concrete which is one of the basic elements in bridge building.

96/ In Chapters VII and IX we shall study the contracting of foreign technology more fully, and analyse the prestressed concrete market in particular.

97/ An example of this is the fact that the large road construction firms must build workshops where, in some cases, they make some of the premoulded parts required for the project. This demands a diversification of equipment of such a nature that it limits the entry of new firms. An example is the Techint-Albano group which has set up large complete workshops for the construction of the Zárate-Brazo Largo rail-road system, or EACA when it built both the new bridge over the Riachuelo or the Paysandú-Colón Bridge.

We reach a similar conclusion when we analyze the firms involved in urban paving, despite the fact that they use a lower level of equipment, which means both smaller relative size of firm and greater spread of supply 98/. This occurs partly because the construction process is relatively simpler: since the product is intended for the use of residential traffic, the paving stones usually lie directly on the compacted earth, which does not demand complex technology nor the development of research departments within the construction firms themselves. The technical advances which may be observed come basically from the are of materials or equipment, and tend to partially modify the construction process.

Thus, as a result of the relatively smaller amount of equipment owned by the urban paving firms and the limited technical complexity of construction, the degree of economic concentration is lower, since the entry barriers for new firms are minimal 99/.

On the other hand, urban paving firms usually own equipment for carrying out sanitation works, since the two kinds of work are often carried out simultaneously. They move from one sub-market to the other with greater ease than is the case for firms in the roadworks sub-market. The new equipment which may be required costs less than that required for road building, and much less than that used in bridge building. In this respect, although they are relatively smaller firms, they have in practice a greater possibility of adjusting to the market, and can thus overcome its possible fluctuations 100/.

98/ The prices of equipment usually employed by an urban paving company are:
1)a mixer; 2) cement deposit; 3) earthmover; 4) grinding equipment; 5) grader; 6) bulldozer; 7) tractors; 8) trucks, etc.

99/ Besides the private firms which carry out urban paving, there are also paving co-operatives with their own citizens and municipal authorities. Examples are the Pergamino and Chacabuco areas (Buenos Aires) where they partially replace private contractors.

100/ A submarket which may marginally resemble that of roadworks is railway construction. Road construction companies are perfectly capable of carrying our railway construction, since both earth moving and bridge construction is similar to roadworks. If the demand is for civil engineering works, all firms possessing the necessary technical capacity are eligible to tender. The remaining railway works are usually carried out by the railway companies themselves of by a group of specialist firms under the supervision of the contractor, who normally determines the basic building standards.

4. Sanitation Works

Like the previous examples, sanitation works can also be divided into two groups which differ according to volume and complexity: on the one hand there are the large works which mainly use high pressure pipelines, and on the other, minor works, such as domestic systems which normally use less complex pipes.

This kind of division also reflects the type of barrier we have already analyzed, since the ability to enter each level of the sub-market varies. The decisive factors are usually connected with the inherent characteristics of the service or with the client's requirements set out in the contract conditions.

However, as the market division is relatively clear - each level differentiated by an input demanding different manufacturing techniques - 101/, the firms which have achieved a better position in the market are those which have based their advantages on the possesion of a proven technology for the manufacture of high pressure pipes. In general, the larger firms, among which multinational subsidiaries are predominant, use technology under foreign license, either from their parent companies (in the case of the subsidiaries) or from third parties (in the case of large Argentine firms).

This occurs both with Impresit-Sideco, Supercemento and Viannini, which form a business group in the market, and with Crivelli, Cuenya and Moronese which have jointly obtained Australian technology under license, or Jaime B. Coll which has a license for Spanish Technology in association with Acueductos S.A. 102/.

Given that these are the firms with the highest relative turnover in the submarket, it could be inferred that the possesion of a proven technology is one of the advantages on which they base their market performance, or in other words, their ability to win contracts.

The foregoing also fits in with one of the comments we made with respect to previous sub-markets: the greater the unitary volume of a work, or the grater its technical complexity or equipment requirements, the greater the participation of foreign capital. In the case of sanitation works, this

---

101/ Construction works using high pressure pipes are examples of made to measure products with highly complex specifications, which differentiates them substantially from those used in secondary or building construction.

102/ We study this point more fully in Chapter IX.

appears both in direct participation (establishment of foreign subsidiaries) and in licensing of the basic technology for the manufacture of relatively complex pipes.

To sum up, many of the observations we can make about the structure of the more complex works in any one of the sub-markets, are also valid for the remainder.

In conclusion, and as final summary of this chapter, we describe comparatively in Table IV.4 some of th characteristics of each sub-market which were set out in the previous pages.

Table IV.4 Structure of Each Submarket (General Features)

	Dwellings	Roadworks	Urban paving	Railway construction	Sanitation	Electromechanical		Industrial Construction
						Lighting	Dams	
Kind of client	Public Sector	Public Sector Only	Public Sector independent of Central Adm. (Municipal Authorities)	Public Sector only (descentralized firm)	Public Sector (O.S.N. Co.) & Municip. Authy.	Public Sector (Electric power distr.firm) Munic. Autho.	Public Sector only	Firms
	Private Sector		Private Sector (neighbourhood assoc.)		Private Sector (neighbourhood assoc.)	Private Sector (neighbourhood assoc.)		
Demand structure	fragmented demand	concentrated demand	Relatively fragmented structure	Concentrated structure	Relatively fragmented structure	Fragmented demand	Concentrated demand	Fragmented demand
Kind of contracting	Public Sector tenders Private Sector direct contracting	Tenders	Tenders Direct contracting (in both cases)	Tenders	Tenders	Tenders	Tenders	Direct contracting. The Public Sector firms usually tender.
Factors affecting entry of firms (Contractors Registers)	Index of contracting capacity for public project tendering only	Building capacity assigned by Public Works registers		Register of Railway construction	Registers of O.S. Nación contractors		Building capacity assigned by contractors Registers	
Supply structure	Fragmented supply	Relatively concnetrated supply	Fragmented supply	Relatively concentrated supply	Relatively Fragmented but stratified supply	Fragmented supply	Concentrated supply	Fragmented supply
Minimum equipment	Low	High	Less than for roadworks	High	Relatively low for domestic lighting networks	Low	High	Higher than housing construction, but lower than roadworks
Technical cpmplexity	Low	Depends on project	Relatively Low	Depends on project	Low for domestic project	Low	High	Depends on project

Chapter V. Entry Barriers and Non-Technological Advantages

Studies on entry barriers have traditionally tended to analyze the advantages of the established firms over their potential competitors, emphasising the fact that the conditions wich create barriers cannot in general be overcome by potential competitors 103/. This means that the analysis does not include the possible advantages of foreign subsidiaries which arise basically from the fact that they enter the market, not as new firms, but by a process through which they absorved advantages abroad which allowed them to dominate their respective markets. It means, in other words, that the subsidiaries themselves took on the characteristics of the corporation as a whole, and in this way were able to partially oust local firms and maintain a significantly high level of relative stability 104/.

But in general, these studies have preferred to analyze branches of industry in which the productive process allows mass production and the manufacturer has markedly greater possibilities of differentiating his products 105/. That is they describe a situation in which the customer's possibilities of choice can be influenced, since he rarely determines the basic specifications of the product he requires. These analyses, which are valid for processing industries, do not necessarily reflect in the same way the situation of an order industry; that is, a situation in which the customer explains fairly clearly the kind of product he requires, which must logically be made "to measure".

Such is the case of the construction industry (and basically public works), since the customer usually sets out in the tender specifications the project characteristics he requires and its technical specifications, with which he affects not only the building process but also the technical and company organization itself.

103/ J. Bain, op. cit. p. 3.

104/ F. Sercovich, op. cit., Chapter II.

105/ Stephen Hymer states that for the American company which sets up a branch overseas, "its advantage may lie in greater experience in mass production techniques; greater experience in consumer goods with a high demand on the American market; better access to develop technology (...) in order to face the battle"; (and others). In general, he emphasises that "the dialect of the product cycle gives capitalism its forward impetus. An innovation is made; if it is successful, the product enjoys a high growth rate as it takes the place of other products and a larger number of consumers begin to use it". Op. cit. pp. 21 and 146. That is, in the industrial sector a company can open a new market with the creation of a new product. This of course allows it to achieve a temporary advantage in the market.

In this way the advantages of the building firms must respond to a situation in which not only "customer sovereignity" is apparently greater, but also the prior specification of the product.

Against this background, we shall analyze the reasons behind the position of the relatively larger firms. That is, we shall examine the nature of their advantages, emphasising particularly those enjoyed by foreign subsidiaries as compared with local firms. More precisely, we shall attempt to compare their different relative advantages, in order to discover the reasons why foreign firms have been able to hold a dominant market position.

I. The Foreign Building Firm as Part of a Multinational Corporation.

The basic factor limiting a building firm's possibilities of carrying out public work arises, as we have already seen, from its maximum possible contracting values and from the kind of works it has previously carried out. The firm which does not comply with these kinds of conditions is unlikely to be able to undertake such works on an individual basis, without resorting to a joint venture enterprise. A local firm can achieve the levels demanded by the institutions calling for tenders only after a period during which it has maintained a rising annual turnover rate. A process not easy to achieve for a firm acting on its own, since it participates in a market where demand fluctuates significantly over time and which demands a high financial capacity; this naturally affects its development. On the other hand, foregin subsidiaries can gain access totthe market by tendering on an international basis (almost all large public works are offered for tender in this way) backed by the additional building capacity and experience of the multinational group as a whole (which they in some cases do by a joint bid with the parent company).

The subsidiary because it is established in the local market, has greater knowledge of demand, and thus is able to bid for large scale works, making sure of a significantly higher growth than that which it would have if it acted independently. That is, simply by its entry into the market, it can minimize the limitations imposed by the requirements for prior building capacity.

In this way they can gain a position on the upper levels of the scale, with out needing to complete all the stages in the accumulative process to which the local builder is subject. The execution of large scale works allows it to repeat the same situation year after year, which of course constitutes one of its relative advantages.

The majority of the foreign capital firms which currently hold dominant positions in the local market are in that situation because they form part of

corporations which operate in several countries at the same time (Table V.1) 106/.

These advantages of the already established subsidiaries are also valid for foreign firms which tender for a public work of an international nature for the first time: they gain access by virtue of achievements accumulated overseas both by their own direct building activity and by the overall performance of their subsidiaries. When they win the tender, they begin to undertake a significant volume of work (the very nature of contracting means that a local firm is unlikely to have the capacity and experience necessary to comply with the tender specifications) which immediately places them among the firms with the highest turnover, thus reducing the barriers imposed by the minimum capacity levels required by large scale public works. If on completion of the first work, they decide to continue in the market, they will find that their contracting capacity has grown, which in turn will allow them to again obtain significant work volumes 107/.

Put more forefully: one of the advantages foreign companies have over local contractors comes from the fact that they form part of the world building market, which allows them to obtain significant shares in the domestic market from the outset. And although it may appear to be tautology, it must be recognized that the advantage of multinational firms lies in the fact that they are multinational 108/.

106/ The firms which dominated the domestic market until 1950 (Table V. 2) were in a similar situation and their parent companies continue to carry out activities outside their local markets without the loss of one of its subsidiaries having implied the reduction of its potential contracting capacity - despite the relative importance it had in the domestic market -. This shows that when one of the subsidiaries ceases activities, the contracting capacity of the group is not reduced, since the contribution of one of the parts is relatively insignificant in the world performance of the corporation. (We have already observed in Chapter III the relatively slight importance of the local subsidiaries within the corporations' total turnover).

107/ The Impregilo group is a clear example, since it entered the local market after having carried out large scale works, such as the hydroelectric power station on the Zambesi (Rhodesia) between 1956 and 1960; the Río Dez power station in Iran between 1960 abd 1963; the Roseires dam on the Blue Nile in Sudan between 1961 and 1966; the Akasombo power station on the River Volta in Ghana (1961/66); the hydroelectric power station at Kainji in Nigeria (1964/68) abd the Tarbella power station in the Indo river in Pakistan between 1968 and 1975.

108/ The foreign firms themselves recognize the benefits of their membership of a multinational corporation. For example, the chairman of Techint, Roberto Rocca, in the Report and Balance Sheet for 1968 says that "knowing and participating in the international activities of Techint Enginee-

Table V.1 Activities of the Foreign Groups Operating in Argentina: Geographic Distribution

Firm	Country of Origin of Parent Company	Number of Building Firms Associated with the Group which Operate in the country of Origin of the Parent Company	Countries where the Group has its subsidiaries and/or itself directly undertakes activities
A. Christiani y Nielsen	U. S. A. /Denmark	s/d	Scotland-Switzerland (Three firms)-South Africa-West Germany-United Kingdom-Denmark-Norway-Bwlgium-Austria-Sweden-Uruguay-Brazil-Thailand-Argentina
Hochtieff A. G.	West Germany	14	Argentina-Brazil-Chile- Iran-Germany
A. G. McKee	U. S. A.	s/d	Australia-Argentina-Belgium-Canada-Chile-France-Italy-Mexico-(two firms)- Spain Bolivia
Austin Sudamericana	U. S. A.	s/d	Argentina-Australia-Canada-France-West Germany-Spain-Holland Italy-(two firms)-England-Japan
Impresit Sideco Impregilo	Italy	16	Argentina-Colombia-Thailand-Soutafrica-Soviet Union-Italy

SADE	U. S. A./Italy	s/d	Colombia-Venezuela-Egipt Brazil-Peru-Spain
Panedile	Italy	9	France-Spain-Argentina-Peru-Switzerland-Brazil
Dragados y Construcciones S. A.	Spain	5	Argentina-Spain-France
Vianini Dragaggi Labori SpA	Italy	2	Argentina-Italy-U. S. A.
Chicago Bridge Iron Co.	U. S. A.	s/d	Argentina-Australia-Brazil-Canada-West Germany Philipines-Holland-Hong-Cong-Italy-England-Japan
Dywidag-Dyckerhoff und Widmann Ac	Germany	6	U. S. A. 'West Germany-South Africa-Argentina-Canada-France-Austria Italy

Source: Author's research and Who Owns Whom, O. W. Roskill, Continental Edition, 1973.

Note: Soc. Comercial del Plata belongs to Columbus A. G. für Elektrische Unternchmungen which controls Italo Argentina de Electricidad.

Table V.2 Foreign Capital Firms which Operated Until 1949/52

(Geographical Distribution of their Activities)

Company	Country of origin of Parent Company	Number of Firms Associated with the Group which Operate in the Country of Origin of the Parent Company	Countries where the Group has Subsidiaries and/or carries out Activivities Directly
GEOPE (Grupo Philipp Holzman AG)	Germany	23	Liberia-Holland-Nigeria and Switzerland
Grun and Bilfinger	Subsidiary of Dresdner Bank A.G. Germany	9	Venezuela-Austria Nigeria-Belgium-and Brazil
Siemens and Bauunion	Subsidiary of Siemens Germany	n/i	Carries out activities in approximately 24 countries, including Mexico-Venezuela-Brazil-El Salvador and Argentina
Societé des Grands Travaux de Marseille	France	31	Brazil-West Germany Canada-United Kingdom

Source: Own research and Who Owns Whom, O. W. Roskill, Continental Edition 1973.

This form of joint action explains in part the dominant position of foreign subsidiaries in the local market: they are the four largest firms in the sector, or those which have carried out most of the basic infra structure works which have recently been completed.

As a result, at this point a question arises which leads us to inquire into the reason why local firms have not managed to expand their activities overseas in order to increase their domestic contracting capacity. The answer lies, in our opinion, in the position the local firms have achieved in the domestic market.

In general, those firms which have succeeded in multinationalizing their activities expanded from a dominant position in the market, exploiting on a world scale comparative advantages which arose from their control over production technology and marketing and their own ability to take advantage of scale economies inherent in the production of the goods they manufacture 109/.

But this process has not taken place with the local building firms, which historically have not achieved dominant positions in the domestic market, almost always being forced out by the multinational subsidiaries into projects of limited technical complexity. This fact reveals their weakness with respect to any attempt to multinationalize their activities, since they have only a minimal capacity to create or obtain advantages which will permit them to dominate the domestic market and then proceed to expand their activities

---

ring Co., being able to take advantage of its support bases in Milan and its offices in New York, Dusseldorf and the work centres in other countries of Latin America, and the Near and Far East, has enabled us to maintain this international contact which today is indispensable because of the increasing links between the economies of the whole world". Or, as we sould say, of the corporation as a whole.

109/ Stephen Hymer, for example, states that the "large firms which invest directly overseas usually belong to oligopolic industries in which each company holds a large part of the market. For example, if we try to relocate these main American investors approximately within the overall American economy, we see that they belong to relatively concentrated industries: 40% belong to industries with concentration rates of over 75%. On the other hand, for American investors as a whole the respective percentage is much weaker: only 8% operate in industries in which the concentration rates are over 75%. Op. cit. pp. 14 and 15. F. Fajnzylber arrives at a similar conclusion when he explains with considerable capacity the relation between the level of concentration, domestic market dominance and the ability of subsidiaries to multinationalise their activities. F. Fajnzylber, La Empresa Internacional en la Industrialización de América Latina. In Corporaciones Multinacionales en América Latina, Periferia, Bs. As., 1973, p. 27.

abroad. In this respect, since local firms are restricted to kinds of projects which can also be carried out by local firms in every country - that is, restricted to an area which can be covered by the firms already established in each country - their possibilities for expansion are reduced, in so far as they unable to carry out complex projects or create technologies or building processes with which they might exploit comparative advantages in the international market.

On the other hand, those which have in fact expanded their activities beyond the domestic market are precisely the multinational subsidiaries which dominate their respective local markets 110/. The local SADE, for example, collaborated with Sadelmi in the rural electrification project along the River Nile Valley in Egypt, and won the tender for the electro-mechanical works for the exploitation of hydroelectric power on the Acaray in Paraguay as a member of the G. I. E. group (Gruppo Industrie Elettromeccaniche per Impiante all'Estero). It also made direct capital investments overseas, by gaining control of part of the shareholdings of the SADE companies in Peru, Venezuela and Colombia, with whom it collaborates in electro-mechanical and industrial projects. The same thing happened with Techint, which has carried out, among other projects, the laying of the jungle oil pipeline in Peru, after winning an international tender on the basis of its experience and capacity gained in the Argentine market; or McKee, which carries out the industrial and oil projects in Bolivia.

These firms have succeeded in carrying out relatively complex works abroad, on the basis, among other things, of their accumulated experience in the domestic market: that is, through participation in similar works, thus ousting local firms which do not reach the minimum capacity levels demanded by international applications for tender. Thus it is that the kind of project carried out by local firms does not allow them to multinationalise their activities, since the barrier to their expansion lies essentially in their limited competitive capacity in relation to the foreign capital subsidiaries which operate locally.

ii. Connections between Foreign Subsidiaries and Multinational Companies which operate in theIndustrial Area.

The construction of civil engineering works for foreign capital manufacturing firms has been a captive market for foreign contractors, allowing them to raise their position on the contracting capacity scale. In general, when a firm backed by foreign capital has been established in the country or has enlarged its plants, it has asked for the services of contractors connected with its group, or of firms which, although they had no direct shareholdings connections, had previously

110/ There are local firms which have expanded their activities temporarily, as is the case of Benito Roggio S. A., who built the airport at Asunción, in Paraguay, among other projects.

carried out similar work overseas.

As this kind of work is carried out by direct contract, without the legal conditions imposed by public institutions, one element which determines the possible adjudication of the project is, of course, the direct connection between the parties involved. Although this kind of contract is completely private, their turnover values influence the percentage assigned by the contractor registers each year, so that the subsidiaries can increase their future contracting capacity and thus improve their position in the public works market.

This situation contributes in the same way as the one described in the previous section to shape an imperfect market, in which local firms have less capacity to win contracts both because of the origin of their capital and their lack of connections with the multinational corporations which invest in the country 111/. In the cases in which they have participated in the construction of civil engineering works for foreign capital industrial firms, they have usually done so in association with foreign contractors, through joint ventures, or independently but carrying out only limited work volumes.

Even when the first foreign capital investments were made, some of the industrial plants were built by firms connected with the investing group, a situation which allowed them to accumulate experience and increase their capacity values to gain a greater volume of public works (Table V. 3). 112/.

There are cases in which the contracting firms have, in their countries of origin, tended to promote their engineering services through their parent companies or one of their subsidiaries, seeking work contracts, for example, among the industrial firms which have made direct investments in this country. They have esentially attempted to see that the work contracts of the

---

111/ Another marginal reason is that their activities are essentially restricted to the domestic market.

112/ In Table V. 3 we describe the works carried out by firms which have financial links and by firms whose relationship appears only in the origin of their capital. Market dependence is not only reflected in the plant construction of the industrial firms themselves. There are also situations in which the construction firm carries out works by order of its local parent company. For example, SADE undertook on behalf of General Electric Argentina S. A. the planning and execution of the civil engineering works of an electricity generating plant in the ESSO refinery and the lighting of the tracks and adjacent areas of the La Plata racecourse. Source: Balance Sheet and Statement of SADE.

Table V. 3 Industrial Plants Constructed by Foreign Contractors

Installation of the Firm	Construction Firm	Origin of Capital of Industrial Firm	Origin of Capital of Construction Firm
Tubos Mannesman	GEOPE	Germany	Germany
Phillips	Christiani y Nielsen	Holland	Denmark-USA
Planta de Esso en Campana	Phillip Massey	U. S. A.	U. S. A.
Duperial	Phillip Massey	England	U. S. A.
Monsanto Argentina	A. G. Mc Kee	U. S. A.	U. S. A.
Agfa Gevaert FIFA (Fáb. Ind. fotográfica Arg.)	Austin Sudamericana	Germany	U. S. A.
Fiat Concord	Techint	Italy	Italy
Petroquímica Bahía Blanca (Mixed firm with a Dow Chemical minority share)	A. G. Mc Kee	U. S. A.	Italy
Compañía Argentina de Cemento Portland S. A. (Plan ext.)	A. G. Mc Kee	U. S. A.	U. S. A.
Propulsora Siderúrgica	Techint S. A. Cometarsa S. A.	Italy	Italy
Edificio Impresit-Sideo (North Carolina	Impresit-Sideco S. A.	Italy	Italy
Edificio Mirafiori (Fiat)	Impresit-Sideco S. A.	Italy	Italy
Dálmine Siderca	Techint S. A. (Proyecto Techint Eng. Co.)	Italy	Italy

Losa, Ladrillos Olavarría	Techint	Italy	Italy
Armco Argentina (zinc and aluminium gal vanizing plant)	Techint	U. S. A.	Italy
Dow Argentine (latex plant)	SADE	U. S. A.	U. S. A.
Central ESSO contracted by General Electric Argentina)	SADE	U. S. A.	U. S. A.
Cometarsa S. A.	Techint	Italy	Italy
Calera Avellaneda ✱	Hochtieff	Germany ✱	Germany
Ford	Austin Sudameri-cana	U. S. A.	U. S. A.
Puerto Campana for Dalmine-Si-derca	Techint	Italy	Italy
Ipako Industrial plant)	Mellor Goodwin	Canada/France	England
Industrias Kaiser Argentina	Kaiser Eng. Co.	U. S. A.	U. S. A.

Source: Author's research

✱ Calera Avellaneda is a local capital firm. However, we have taken this case into consideration, since the Hochtieff contract to carry out the civil engineering works was due to a technological turnkey contract between Calera Avellaneda and Klockner Humboldt D. Deutz of Germany, which provided it with the equipment for the expansion of its industrial plant. This example illustrates an advantage arising from inclusion in foreign industrial groups which have placed their products through turnkey contracts which include the execution of the civil engineering works.

foreign capital companies were channelled to their subsidiaries, and in this way they naturally tended to create a kind of differentiation with respect to the local building firms. An example of this is SADE, since it signed a contract with Sadelmi, an American firm associated with General Electric (that is, a group company) to promote its services among the United States firms which have industrial plants in Argentina, with the aim of winning contracts to carry out their civil engineering works, There is logically an annual exchange of dollars between the two firms, which can be considered a way of sending dividends abroad, since, as there exists a legal connection between them, the greater work volumes carried out by the local firm naturally imply higher profit levels for the group. In any case, the contract itself is an example of one of the ways in which a local subsidiary can win work contracts with the foreign firms established in the country.

In this way, the parent company itself or any one of its subsidiaries can be, for the foreign building companies, an efficient vehicle in the search for work contracts, without an explicit contract between the two parties being necessary, as in the case we have analyzed. The multinational nature of the group allows them to have a greater market knowledge, and therefore, a more favourable competitive position in relation to local contractors, since they have captured a market whose demand is directly connected with the volumes of foreign capital investment.

III. Links between Foreign Capital Building Companies and International Equipment Manufacturers and/or the Purchasing Channels of their Respective Parent Companies.

The levels of equipment required for the execution of large scale works is one of the basic limiting factors preventing construction firms from gaining larger shares in the market. In this area, foreign capital firms have a relative advantage over local contractors, because of their membership of international groups, being able to use their purchasing channels or obtain finance for equipment of a significantly different scale and volume from local firms. This gives them four advantages arising: 1) from the group's greater knowledge of the market which allows them to purchase from firms which offer them a lower relative price; 2) from the possibility of their including their purchases in the demand volumes of a group as a whole and thus achieving a lower unitary price 113/ 3) from the use of the purchasing channels of the parent company, which allows them to reduce the time between order and delivery; 4) from being able to participate in the financial facilities which the supplying firms grant to the parent company or any of its subsidiaries on the basis of the volume of purchases made by

---

113/ In general it resembles the multinational corporation's ability to coordinate internationally the acquisition of supplies as a scale advantage. Among others, see J. Bain, op. cit. pp. and ff.

the group as a whole.

These four advantages are of considerable importance if imported equipment is required, and place them in a markedly different situation from local firms which, when they gain access to the market on an individual basis, do not have clear information concerning supply, nor concerning the possibility of obtaining foreign finance rapidily for the purchase of their equipment. This naturally reduces their possibilities of carrying out large scale works and, naturally limits their true contracting capacity.

In the case of local subsidiaries, their supply of equipment and spare parts from abroad was obtained through four different purchasing channels: 1) by direct imports from the parent company or from the group's subsidiaries, the most outstanding examples being:

- Impresit-Sideco, which in 1972/73 acquired 35% of its equipment and spare parts directly from the Imprese Italiana All'Estero.

- SADE, which acquired through Sadelmi Cogepi of Italy in the same period 12.5% of all its spare parts, and because of its links with the sales and purchasing channels of General Electric Argentina, which at the beginning of the sixties had a Technical Equipment Commercial Division in the country, which distributed equipment manufactured in the U.S.A. (grinders, finishing machines for pavements, excavators, compacting rollers, cement mixers, etc.)

- A. G. McKee, which in 1972/73 acquired directly from its parent company (Arthur G. McKee of the United States) 95% of its equipment ans spare parts, a value which represented 85% of its imports.
- Techint, which acquired, for the execution of the Benjamín Reolín hydroelectric power station in Córdoba, for example, machinery and equipment from Ansaldo San Giorgio SpA of Italy.

- A. Christiani y Nielsen S.A., which in the early sixties was the local distributor for Tornborg and Lundberg AB of Sweden-Denmark (cement companies); A. B. Vibro Verken of Sweden and U.S.A. (vibration rollers) and of the Swedish firm SAWO, which makes cement plants.

2) By employing the purchasing channels of the parent company in the country of origin, a method used by:

- Dragados y Construcciones (DYCASA) which acquired some of its equipment and spare parts in Spain; and
- Techint, which imported 11% of its equipment from Italy in 1972/73.

3) By direct transfer from different works carried out by the group abroad. That is, a method of reallocation of equipment between the various subsidiaries

114/; and
4) From third parties using the group's purchasing channels.

These connections, which are reflected in advantages for the foreign subsidiaries in importing their equipment and spare parts, also reflect the direct connection they maintain with some large international manufacturers of heavy construction equipment. For example, the Impresit group, with which Impresit-Sideco, Impregilo and Supercemento, among others, are linked, belongs to Fiat S.A., which has merged at the international level with Allis Chalmers & Co. of the United States (one of the largest manufacturers of heavy machinery) thus forming the Fiat-Allis company which has plants or sales offices in 125 countries.

The local firms which belong to the group do not, like the remainder of the construction firms, suffer from the limitations resulting from the minimum equipment levels demanded by large work volumes. Impregilo, for example, has used complex heavy equipment manufactured by Fiat-Allis in three of the largest public works in the country (El Chocón, Salto Grande and the Chaco-Corrientes bridge) 115/.

On the international level, the merger of these firms coincided with the expansion of the Italian construction firms of the Fiat group into large scale public works (for example, those carried out in Italy, Argentina, Pakistan, Colombia, Iran). In this way they eliminated one of the major entry barriers simultaneously creating a vertical linkage which places them in a more favourable competitive position.

IV. Vertical Linking of Building Firms

The price adjustment mechanisms which rule public works tenders enable the contractor to adjust his costs on the basis of only two factors: labor and

---

114/ For example, for the construction of Salto Grande, it imported part of the equipment it employed both in the construction of the Tarbela dam in Pakistan (caterpillar excavators, tip trucks, tower cranes and motor pumps) and those it used in the construction of Chivor in Colombia, from where it imported motor pumps. The transfer of equipment from Tarbela took place from 1975, the year that construction was finished. This is an example of a kind of complementation and timing in the use of its heavy equipment.

115/ The equipment manufactured by Fiat which Impregilo uses in its projects are, among others, retroexcavators, front loaders, vertical loaders, generator sets, dumcretes, lorries, tractors, buses, and a large number of cars and vans.

materials input for construction. Only international tenders authorise readjustments to the total cost of the work, since adjustments to the profits determined at the beginning of construction are usually not recognised. This means that, especially during an inflationary period, the true profit obtained by a firm is lower than the expected rate. The absolute value of profits remains unchanged, but both rates differ as the final cost varies because of increases in the input or labor costs.

If the firm is vertically linked, it can succeed in minimizing the effect of the reduction in its profit rate through the price adjustment mechanism, since it is possible for it to form a dependent market for its associated firms and absorb the differences in costs in the group. In the same way, and depending on the degree of control these firms have over the input market, they can at the time of tendering fix differential prices with the aim of winning the contract, and push out potential competitors who must perhaps keep to the price fixed for them by the supplier to whom they are linked 116/.

These discriminatory policies may allow the group to gain larger shares of the market and cover itself against reductions in the profit rate, since it operates, not in the closed market of an individual company, but within a group which maximizes at group level 117/

In the local market, the foreign subsidiaries which have formed vertical links are:

a) SADE, subsidiary of General Electric of the United States, which controls a group made up of:

- EMA, Electromecánica Argentina S. A., which makes some of the materials employed in the laying of transmission cables and electricity generating and distributing plants.

- SCAC, Sociedad de Cementos Armados Centrifugados, which make premoulded parts (cement posts and towers and a wide range of pre-fabricated parts) and has a dominant position in the market, since it controls approximately 65% of the total supply of premoulded parts.

116/ Sylos Labini states that in these cases "the greater the degree of concentration, the more likely are forms of horizontal and vertical linkage and price leadership situations. Op. cit., p. 19.

117/ We shall study this point more fully as a variable of company behaviour in the following chapter.

- Morsela S.A., tools and equipment manufacturer for electrical and mechanical installations.

- Blockret S.A., manufacturer of articulated cement paving; and

- Imar S.A., involved in steel.

These five firms supply SADE with the basic elements it uses both in its electro-mechanical works and in road systems. In the last few years, SCAC has becomes one of the main suppliers, having offered its services also jointly for constructions requiring the use of premoulded parts for works which, through their own technical specifications, modified the kind of inputs employed 118/.

Such linkage fits in perfectly with the main activity of SADE (laying technical networks), since all elements except the cables, are provided by EMA, SCAC Imar and Morsela. The same thing happens for some of its civil engineering and bridge works, in which it is feasible to replace traditional elements with premoulded articles made in the factory.

b) Another vertically linked group is Techint which controls:

- Dálmine-Siderca, which makes steel structural materials. (In Venezuela and Mexico the group controls two firms of the same name, "Andamios Tubulares Dálmine S.A., which are involved in the supply of structural building materials);

- Losa, Ladrillos Olavarría S.A., manufacturer of red ceramic materials (bricks, tiles, etc.), which controls approximately 20% of a very fragmented market in which there is a high participation by local firms;

- Elina S.A., construction firm, concerned with the laying of energy transmission networks 119/;

- Comasier S.A., which markets iron and steel materials;

- Propulsora Siderúrgica S.A. (Iron and steel);

- Cometarsa S.A. and

- Apipé S.A., quarrying.

118/ An example of this are the stations of the Retiro-Tigre line, since in the joint bid made by SADE-SCAC they substitute for the traditional materials set out in the tender specifications premoulded materials made by SCAC.

119/ It currently produces its balance sheet in conjunction with that of Techint.

Unlike SADE, which, because of its links with SCAC, uses premoulded cement materials, The Techint-Elina group employs tubular steel structures in the construction of transmission networks, usually obtained from its associated plants. To a certain extent, the vertical linkage itself determines the kind of inputs they will use in each construction, as long, of course, as there is some degree of technical flexibility allowed by the licensing institutions.

c) Impresit-Sideco, is another example of vertical linking, since it is connected with:

- Fiat Concord, which manufactures tractors and heavy construction equipment;

- Geosonda S. A., which undertakes the laying of special foundations;

- Supercemento S. A., concerned with the construction of sanitation works and high density housing and which has incorporated into its organization a cement pipe factory, a granite quarry (Canteras Casa Bamba S. A.) and a firm specialized in marine works, Dragados y Obras Portuarias S. A., and

- CAMSA, Compañía Argentina de Medidores S. A.

Impresit-Sideco is also connected at the local level with 5 construction firms which all share the benefits of this link: Silos Demaco Construcciones; Mirafiori Construcciones S. A.; Impregilo; Edificaciones Continental S. A.; and Supercemento S. A.

A fourth example of vertical linkage is Pirelli S. A., which added to its production line (the manufacture of wires and electric conductors) as installations department, which in practice operates as a construction firm for lighting networks, since it bids individually for public works. This kind of linkage, based on the expansion of activities within the same organization, like that carried out through dependent companies, is found in firms which have significant control of the sector 120/.

120/ The German firms which dominated the construction industry until the end of the Second World War were in a similar situation. La Compañía Platense de Construcciones, for example, was formed because of the expansion of Siemens-Schukert, which provided it with some of the electrical materials it used in its constructions, or the same German building group which was linked with the metalurgical industry through TAMET and Tubos Mannesmann or with the cement industry through Loma Negra and Calera Avellaneda; Somi explains that "no home or foreign consortium had the same kind of organization as the Germans. German construction firms form part of an enormous

The situation of local firms which have not developed a degree of linkage like that of the multinational corporations is different. The examples to be found are very few, and only seven examples can be mentioned as outstanding 121/.

- Gardebled Hnos. S.A., which controls:

  - Maquivial S.A. (distributor of road building machinery)
  - Matevial S.A. (Transport of road materials) : and
  - Cantesur (quarrying).

- Sebastián Maronesse S.A., which controls:

  - Cerámica Argital S.A. (red ceramics);
  - CIMAC CIFSA (sale of building materials);
  - Fábrica Argentina de Caños Rocla S.A.; FACRO (reinforced concrete pipes)

- Crivelli-Cuenya S.A., controls:

  - Fábrica Argentina de Caños Rocla S.A.; FACRO (reinforced concrete pipes); and
  - Río Cincel S.A. (mining).

- Constructora Creste Biasutto e Hijos S.A., which controls:

  - Cerámica Argital S.A. (red ceramics)

- Jaime Bernardo Coll S.A., which controls:

  - Acería Bragado S.A. (iron and steel)
  - Acueductos S.A. (reinforced concrete pipes factory); and
  - Aceros Bragado Lucini S.A. (iron and steel).

---

companies combine, which produce or import all the materials necessary for the works, thus enabling them to operate to greater advantage in the area of tenders. Iron, cement, stone, electric appliances, pipes, fibrocement and other materials are supplied by the industrial or commercial firms which form part of the German group itself", op. cit. p. 207.

121/ We have obtained this information both from our own research, and from the 1972 Firms' Guide.

- Cía. General de Construcciones S.A., which is linked to:
  - Guillermo Decker S.A. (factory making bronze drainage pipes).

- Burgwardt y Cía. S.A., linked with:
  - Alquimac S.A. (hire of equipment and technical advice to building companies) 122/.

Despite its apparent lenght, this list shows that the association between local contractors and materials or equipment suppliers is of slight significance. There are, for example, only a small number of suppliers of any importance, and apparently their connection does not have the same kind of significance as that between the foreign subsidiaries. One explanation for this is that, unlike the foreign firms, the local builders have generally begun in the construction branch, and their process of accumulation has always been influenced by market fluctuations which limited their possibilities for vertical linkage.

On the other hand, the foreign firms which have formed links, have usually done so by the expansion of a manufacturing firm which entered the local construction market after its initial capital investment. This is, perhaps, one of the basic reasons behind their linkage, since they enter the market through the expansion of a firm which has participated indirectly in the building industry by supplying materials or equipment. The most outstanding examples are General Electric, which was established in 1926 and set up SADE in 1947 to carry out electro-mechanical works; Pirelli, which installs its electric wire manufacturing plant in 1921, and in 1950 develops its installations department; Techint, which makes its début at the international level in the iron and steel area as part of the Instituto per la Riconstruzione Industriale and subsequently develops its linking organization in this country; or Impresit - Sideco, which was set up six years after the establishment of Fiat (1961-1965).

We see then, that their parent companies join the construction industry after setting up an integrated organization at both the international and local

---

122/ We have found two outstanding cases of links between suppliers: the Palmar-Astori group, which made its start in the manufacture of red ceramicsand metal structures, and subsequently created Cer, CIFSA which builds to the official plans of the Secretariat of the State for Housing, and Siam Di Tella Ltd. which takes part in the construction of electro-mechanical works either directly or in association with building firms, since it has already carried out, for example, the electrification of the Necochea district on an independent basis.

level, which has allowed them to absorb their comparative technological advantages and their capacity to exploit scale economies arising from minimum plant size.

In contrast, when the local firms initiate their activities in the construction area, they must begin a process of slow growth, since they have their own contracting values as their maximum limit for expansion. They must carry out reinvestment within their firm, which limits their capacity for vertical linkage 123/.

V. Ability to obtain Foreign Credit

In the previous chapters we saw that one of the basic variables limiting the capacity to undertake all kinds of construction is related to a construction firm's ability to gain access to sources of credit. Public works usually demand that the contractor have the resources to face the lack of synchronization which occur periodically in payments, or else to cover the financial guarantees required, in some cases, by the conditions of contract.

As construction firms operate with a capital of their own which is significantly lower than their turnover volumes, the firm which has its own finance or has relatively easy access to bank credit naturally has a greater degree of autonomy to win work contracts. Or it can - in the case of housing construction - initiate plans with its own financial backing. This allows it to increase the speed of its capital turnover, and logically reduce the effect of its fixed costs on the tender price. It is usually observed that in the local market foreign subsidiaries have a relative advantage due to their direct membership of financial institutions, and of their greater ability to go into debt because they are underwritten by multinational groups 124/.

123/ From the company registers it emerges that the local suppliers of materials which dominate oligopolic markets (cement factories or chalk manufacturers, for example) have expanded, not into the construction industry, where market fluctuations and financial restrictions make their situation unstable, but into, other kinds of activities (preferably agricultural). (See Firms'Guide). Foreign capital control itself over part of the local materials and equipment market limits the decisions to integrate of the suppliers to the sphere of their respective parent companies, which limits the possibility of a linkage stemming from the industrial sector.

124/ This point has been studied in great detail by, among others, Joe Bain, op. cit., p. 16, Sylos Labini, op. cit. p. 24; Stephen Hymer, op. cit. p. 153; Informe del Comité de Finanzas del Senado de los Estados Unidos, published in 1975 by Editorial Periferia, Buenos Aires, p. 75 ff., and Francisco Sercovich, op. cit. p. 43.

The possible foreign financial sources are both the institutions linked with their corporation and the channels opened up by the latter but independent of the group. In the local market the subsidiaries which have employed in-corporation finance can be divided into four categories 125/: a) subsidiaries belonging to a corporation directly controlled by a financial institution whose activity is the main one in the group, a situation pertaining to:

- Dragados y Construcciones S. A. and its group of associated firms (Dycasa Dragados y Construcciones S. A.; Roggio Dycasa Auxini Dragados S. A.; Auxini, Empresa Auxiliar de la Industria y Centro Corrientes S. A.), whose parent company is the Banco Central S. A. of Spain, backed by private capital and which controls, among other things, the Banco Vitalicio de España S. A. and the Banco de Fomento S. A. of Spain. Locally the group controls the Banco Popular Argentino.

- Supercemento S. A., whose parent company is the Banque de la Construction et des Travaux Publics of France, which controls among others, the Banque pour la Construction S. A. of Belgium, and the Etablissement Financier de la Construction et de Travaux Publics (ETAFINTRA), which is the direct owner of the shares of Supercemento S. A.; and

- La Sociedad Comercial del Plata, which belongs to the Swiss financial group made up of the Societé Priveé de Banque et d'Gerance, Credit Suisse, and the Compañía Suizo Argentino de Inversiones y Finanzas S. A.

b) Firms belonging to a holding company made up of financial institutions, industrial and construction firms, a situation pertaining to:

- Panedile Argentina S. A., which belongs to the Montecatini Edison group and to the IRI, Instituto per la Ricostruzione Industriale (Italy) which at the international level controls approximately 510 firms, among them, the Banca Commerciale Italiana SpA; the Banco di Roma, the Banco de Santo Spirito, the Banque Europeenne de Crédit a Moyen Terme (BEC) of Belgium, and the Sociedad de Crédito Italiano SpA. Montedison also controls, among others, SADE Finanziaria Adríatico SpA and the Banco Lariano SpA.

- Techint S. A. and its group of associated firms (Elina S. A., among others), which are controlled by Techint Engineering Co. through the I. I. I. company with headquarters in Panama, as part of a group which controls financial and industrial institutions in Milan, New York and Dusseldorf; and

---

125/ Some of this information has been taken from the 1973 Who Owns Whom (published by O. W. Roskill and Co. of London).

- Rodio Argnetina S. A. belonging to Holding Rodio S. A. with its headquarters in Switzerland.

c) Companies linked with corporations whose main activity centres on the production of industrial goods and which incorporated of created financial institutions during their process of expansion:

- SADE, Sociedad Argentina de Electrificación S. A., which belongs to the General Electric Company Co. group through the Compañía Generale di Elettricita SpA, in which Fiat SpA of Italy also has a share;

- Impresit-Sideco and its group of associated companies (Demaco S. A. and Mirafiori S. A.), belonging to the Fiat SpA group wich controls, among others, the Commissionaria Internazionale S. A. R. L/ Company.

- Impregilo, whose share capital is controlled, among others, by the Impresa Italiana All'Estero SpA backed by capital also belonging to the Fiat group and linked in turn to the IRI 126/.

d) Finally, the subsidiaries of a group originally involved in building, which has developed its own financial channels. At the local level, the most outstanding examples are:

- Arthur G. McKee Argentina S. A., whose American parent company established, among other firms, McKee Intercontinental, with headquarters in Panama, to channel the corporation's financial inflow;

- H. T. A. Hochtief, subsidiary of the German Fur Hoch-Und Tiefbauten company;

- A. Christiani y Nielsen S. A., which has incorporated financial channels both in Denmark and in the United States; and

---

126/ To build Salto Grande, Impregilo obtained the financial approval of the Banca Commerciale Italiana, which is directly linked to its parent companies. This was an explicit requirement in the adjudication of the project, and was one of the main entry barriers for local firms. The Cámara Argentina de la Construcción itself states that "a problem which daily reduces the possibilities of Argentine firms in relation to their foreign opposite numbers with regard to the price and construction of large scale engineering works are the guarantees demanded by the banks to finance constructionworks which, because of their size, involve a turnover many times higher than the capital of the firm involved". Op. cit. p. 4.

- Novobra S. R. L., whose parent company was locally the licencee of the port of Rosario,

This kind of connection, which enables internal credit to be used, is further complemented by the ability of the subsidiaries to make use of fiancial channel which, although not directly linked with their parent company, are usually used by the group as a whole: they have access to lines of credit available simply because they form part of a multinational corporation. According to the Cámara Argentina de la Construcción, "foreign firms not only have the approval of their own governments, but also the credit support of the banks of their countries of origin, to an extent completely beyond the possibilities of local firms" 127/ 128/.

In order to illustrate this kind of connection we have analyzed for a sample of eighteen subsidiaires the drafts they sent out of the country, ten of them towards credit repayment and interest for the period 1972 and 73 (Table V. 4) 129/.

In the case of the firms analyzed it can be observed that the majority have used credit from their parent companies for over 65% of the total value, while the firms which used sources of credit outside the corporation apparently did

---

127/ According to the Chamber, "this explains why almost all the large public works presently under construction are carried out by foreign firms", so that "Argentine firms will never be able to achieve either the dimension or the background necessary for carrying out large scale works".

128/ The German firms which controlled the local market until the early forties also obtained advantages because of their membership of multinational financial groups. For example, some of the public works were financed during that period through Argentine loans placed in Germany; such as, among others, those contracted by the Province of Buenos Aires in 1908 to carry out sanitation works, or those obtained between 1908 and 1914 by the Buenos Aires City Council for urban paving and building construction or for the excecution of public works in 1936. Some of these works were carried out by German construcgion firms, through agreements with the financial institutions which granted the loans. In relation to this, see Somi, op. cit.

129/ Although we do not have information regarding the amount and origin of the foreign credit obtained by these subsidiaries, we believe the drafts allow us to infer a prima facie use of foreign sources of credit. One of the restrictions of this indicator is that a subsidiary can transfer ner assets in the guise of interest payments or credit repayments. Despite this, we consider that it allows the assumption of a credit flow, although its size could be less than that stated.

Table V.4 Overseas Drafts for Repayment of Credits and Interests in 1972-74 Made by Foreign Firms

Firm (Main activity)	Overseas Drafts for Repayment of Credits & Interests Payments thousand $ ley		Overseas Drafts for Repayment of Credits & Interest Payments in Relation to Total Turnover (%)		Drafts for Repayment of Credits & Interest Payments in Relation to Total Drafts 1972/73	Origin of Credit	
	1972	1973	1972	1973		% Third Parties	% Parent Company or firm
Infraestructure & eng. projects (A)	64,880	48,526	43,1	15,7	100%	100	-
Infraestructure & eng. projects (B)	Has a non-transferred balance of		8,5	5,8	70%	35	65
Infraestructure & eng. projects (C)	7,530	6,870	5,1	1,8	90/35%	100	-
Eng. projects	2,955	5,161	2,8	6,9	60%	20	80
Infraestructure (roadworks)	Has a non-transferred balance of 6,273		44,4	22,7	100%	-	100
Infraestructure projects	560	6,261	s/d	s/d	100%	-	100
Housing (Public works)	425	-	1,5	-	100%	95	5
Housing (private works	47	51	0,4	0,4	100%	100	

Parts for infra-structure projects (A)	86	79	0, 9	0, 5	15%	-	100
Parts for infra-structure projects (B)	76	-	0, 5	-	10%	-	100

Source: Drawn up by author from information gathered from the Dirección de Inversión Extranjera.

so with its approval 130/ .

In general, it emerges from Table V.4, that:

a) For the large firms, foreign indebtedness has made up significant part of its turnover value. If we bear in mind that the information refers to credit repayment and interest instalments (accepting as a hypothesis that repayment takes place over a period of more than a year) it can be inferred that a significant proportion of their work certificates have been covered by foreign finance;
b) the firms which obtained the largest foreign credits were those with the highest relative turnover;
c) repayment of credit and interest had been the main item for which these firms have transferred money. Only two firms have done so for other items and they were those which contracted technology from their parent companies by licensing all their sales;
d) finally, it can be concluded from the sample that foreign indebtedness - in relation to turnover value- was greater for the firms which undertook engineering works or the construction of industrial plants for state companies, than for housing construction firms or those which exploit their technology through parts manufacture. This to a large extent corroborates our hypothesis that they are firms which have obtained some of their advantages (in the construction of engineering works) because of a combination of two elements: their own financial capacity and their direct connection with credit institutions 131/.

Now, if we compare this kind of network with those developed by local firms, we can see that because of their nature they have not been able to reduce the advantages held by the foreign subsidiaries. Not only is the number of connections limited (only 12% of the local firms placed among the 40 largest in the 1963/69 period had such connections Table V. 5, but their ability to obtain foreign credit in practically nil since because of their size and contracting volume they do not usually comply with the minimum demands imposed by the foreign financial institutions. Their capacity revolves around the possibilities of their gaininig entry into the local financial structure, or of possible approval the State may give them to obtain foreign credit, since they do not have the ability to do so on an individual basis.

130/ This emerges from an analysis of the Reports and Balance Sheets for these years.

131/ Of course, the possibility of using drafts for repayment of credits as a way of transfering net assets abroad could throw doubt on this statement. Although, as we shall see later, these drafts correspond directly with the amounts of credit obtained.

Table V.5 Direct Links Between Building Firms and Local Financial Institutions

Banks & Financial Institutions	Building Firm	Type of Connection	Position of Firm in Market and Origin of Capital
Español del Río de la Plata	Hijos de Aragón Valera C.E.S.A. (cons. y edific.)	Between members of Board	
Viviendas Cenit Argentina S.A.	Vademar S.A. (const. y venta de propiedades)	"	
Español del Río de la Plata			
Viviendas Guillermo A. Peña y Hno. (ahorro y préstamo para la vivienda)	Guillermo A. Peña S.A. C.I.	Between members of Board	
Nuevo Banco Italiano	Sociedad Comercial del Plata S.A.	Between members of Board	Firm backed by foreign capital
	Argecons C.I.C. A.F.I. S.A.		
Columbia S.A. Ahorro y préstamo para la viv.	Cía Suizo Argentina de Const. Civ. S.A.		
	Edificadora Cielos Argentinos S.A.	Between members of Board	
Banco Mercantil Argentino	Christiani y Nielsen Cía. Arg. de Const. S.A.	"	Firm backed by foreign capital
	Chacofi S.A.C.I.F.I.	"	

	Adanti Solazzi y Cía S.A.	Beetwen members of Board	Firm backed by foreign capital
Banco de Crédito Provincial	Industria Arg. de Const. y Urb. S.A. (IACUSA)	"	
	Fiorito Hnos. y Bianchi S.A.	Between members of board	
Banco Popular de Quilmes	EASA Empresa Arg., Concesionaria de Const. Obras Públicas S.A.	"	
	Conevial S.A.	"	
	Pailco S.A.	"	
	ECOFISA Empresa Const. Fin.	"	
	Benito Roggio e Hijos Empresa Const. S.A.	Between members of board	
Banco del Interior de Buenos Aires S.A.	Roggio Dycasa Auxini Dragados S.A.	"	Dragados y Constr. holds part of share capital
	Dragados y Const. S.A.	Control of shareholding and between members of Board	Firm backed by foreign capital
	Const. Sudamericana S.A.		
Banco Popular	Roggio Dycasa Auxini Drag. S.A.	"	
	Arco Iris S.A. mant. integral de edificios)	"	
Cía Arg. de Crédito S.A.	Welber, Unsúa S.A.	"	

La Franco Arg. de Capitalización		
Pereiraola S. A. (invers. inmob.) Financiera del grupo Pereira Iraola	Burgwart y Cía S. A.	Control of share-holding and between members of Board
Comercio Español y Argentino Compañía de Seguros S. A.	Polledo S. A.	Between members of board
	Francisco Natino e Hijos S. A.	

Source: author's research and Guía de Sociedades Anónimas, 1972.

Note: The German firms which were seized after the Second World War also formed part of the local financial structure, since S. A. F. H. Schmidt was linked with the Banco Español del Río de la Plata, Wayss y Freytag and Compañía Gruen y Bilfinger to the Banco Germánico de la América del Sur, and Siemens Schickert to the Banco Transatlántico Alemán. In this connection, see Luis Sommi, op. cit.

In practice, they had also to face tender specifications which lacked the financial advantages granted in tender applications open to foreign contractors. An example of this is a comparison between the specifications for El Chocón - international in nature - and Futalelfú, which was restricted solely to local firms. As we can see in Table V.6, the financial advantages granted to the El Chocón contractor are substantially different from those for Futalelfú 132/.

To a great extent this shows how the tender specifications themselves - which are determined at the local level - can further accentuate the relative advantages which the multinational corporations already have in the financial area.

Conclusions

We would be unlikely to consider a priori that the entry barriers in a sector in which demand conditions are relatively rigid are created or overcome in the same ways as branches where it is supply which has a greater capacity to adapt its own market. It is natural that this should be so, since in both cases the role of each of the parties is essentially different. In the case of the construction sector - and especially public works -, since the client is the one who determines a priori the kind of product he requires, and also the characteristics of the firm which can produce it, this logically makes the entry of new firms into the market respond to different determining factors from those of an industry in which the client makes no specification prior to the appearance of the finished product. Here entry barriers are especially connected with absolute advantages in the cost of manufacture, product differentiation and scale of production and distribution 133/.

In the case of an order industry like the construction industry, in which mass production is insignificant, scale of production and even less, product differen-

---

132/. Vialco S. A., the local company which built the first stage of Futalelfú, called a meeting of creditors while the project was in progress because of financial problems. Quite apart from the controversy this provoked, we believe that it is a clear indication of the importance of financial capacity as a barrier to the execution of projects of high unit cost.

133/ Among other articles, those by Joe Bain and Sylos Labini which we have already mentioned, and the article by Franco Modigliani, New Developments on the Oligopoly Front, in Readings in the Economics of Industrial Organization; edicted by Douglas Needham, Holt, Rinehart and Wiston, England, 1971, pp. 194-213.

Table V.6 Financial Specifications in the Bids for El Chocón and Futalelfú

Areas in which Advantages have been granted	El Chocón	Futalelfú
Taxes	Tax exemption Reductions, refunds and relaxation of customs duties and surcharges	No tax exemption were granted
Equipment	The contract includes total financing of special equipment to carry out the project whether it be Argentine and/or foreign, and the value was discounted in 30 instalments without interest beginning from the 13th month after the start of the contract	No financing was envisaged for the acquisition of special equipment
Payment of work certificates	The date for payment of certificates was fixed at 30 days	The date was fixed at 105 days
Currency of payment	Payments were to be made in foreign and local currency in the proportion required required by the contractors	The documents allowed payment in local currency

Source: Cámara Argentina de la Construcción.

Notes:

1/ This list is incomplete, although it shows fairly clearly one of the market imperfections: the independence of work contracts. Source: Author's research.

2/ The information set out both in this section and the following ones has been gathered from five sources in particular: Balance Sheets and Statements of the firms analyzed; Companies Guide, 1972; Foreign Investment Register specialist magazines (Construcciones; Revista del Cemento Portland and Summa, among others) and personal interviews with members of the firms.

tiation, are unlikely to become entry barriers 134/.

More relevant are the advantages which allow the conditions imposed by demand (minimum contracting values, financial approval and accumulated experience, for example) to be overcome, or a firm's own ability to adjust its "mobile plant" to non-repetitive "in situ" constructions. If there is no express decision by the client to make his pre-conditions less demanding, as we have seen throughout the chapter, then advantages derived from the operational level prior to the multinationalization of the firm's activities or advantages inherent in the nautre of a group (vertical linking, or possibilities of obtaining credit or financial approval) exercise an influence.

It is not surprising that the ability to overcome this kind of barrier is, to a great extent, part of the inherent structure of a foreign firm. For example, they are the ones who can most easily achieve the minimum levels of experience required by the client, or have a greater ability to provide the financial endorsements which limit market entry (see by way of summary Table V.7). The composition of supply in the local construction industry reflects this ability of the foreign subsidiaries to internalize advantages which allow them to overcome the limitations imposed by the factors which determine demand: their greater participation in more concentrated markets is, of course the logical result of a process in which the client's role has a direct influence on the supply structure. In practice, the multinational groups have almost always adapted to changing demand situations without "consumer sovereignty" influencing their performance as a basic factor limiting its expansion or its consolidation in branches of a different nature.

Appendix

We give below details of the groups which at the international level make up the multinational corporations to which some of the local subsidiaries are linked. The information was gathered from Who Owns Whom for 1973 (compiled and published by O.W. Roskill and Co. Ltd. of London, England). In practice we describe only those firms which are directly or indirectly linked with the sector, and the financial institutions dependent on each group

---

134/ Two industries in which product differentiation is most well known as an entry barrier, are probably tobacco and drinks. In these branches, publicity costs have a greater weight within the cost structure and their volume alone limits entry of new firms. In this respect, the difference with respect to the construction industry is highly significant, since rarely (or only on a small scale) does a building firm advertise widely.

Table V.7 Links between Local Subsidiaries Backed by foreign Capital

	SADE	PANEDILE	IMPRESIT-SIDECO	IMPREGILO	TECHINT	(DYCASA)	SUPERCEMENTO
Local suppliers of building materials & Services	* Ema, Electro Mecânica Arg. S.A. * SCAC, Soc. de Cem. Arm. Centr. * General Electric * Blocket S.A.	-Dálmine-Siderca (through Fin. Ital. Arg. S.A. - Paolini S.A.	Geosonda S.A. (special cimentations)		* Dálmine-Siderca * Losa Olavarría * Propulsora Siderúrgica * Comasinder S.A. * Ajijé S.A.(expl. de canteras)		* Canteras Casa Bamba S.A. (piedra granítica)
Foreign materials suppliers	* General Elec. Co.	*Montecatini Edison S.A. * Finanziaria Siderúrgica (Controls Dálmine SpA owner of: - Dálmine Siderca Arg. - Andamios Tubulares Dálmine de Mexico y Van. & others.	* Auxiliaria Lavori Moncenisio SpA		* Ansaldo San Giorgio SpA of Italy	* La Cruz, Minas y Fund. de Plomo S.A. * Española de Zinc S.A. Cía. Esp. de Petroleo S.A. * Minero Siderúrgica de Ponferrada S.A.	
Local eqip. suppliers	* Morsela S.A.	-	* Fiat Concord S.A.	* F.Conc.S.A.	* Cometarsa S.A.		*Dragados y Obras Portuarias S.A. (maritime works)
Local financial institutions	* Bco. di Napoli * Bco. Río de la Plata (Pérez C. group) * Financiera Elec. S.A.	* FIASA Fin.Arg.	- Bco. Fr. e Ital. - Bco. Ind. y Com. de Córdiba S.A. - Bco. Rural Arg.S.A. - Bco. Coop. de Caseros - Grupo Fin, Ital.		* Sta. María S.A. (finance Co.which owns part of the shareholders of Techint)	* Bco. Pop. Argentino (branch of the Central Bank of Spain	* Sto. Dom. de Guzmán (financing operations) * Bco. Crédito Arg. S.A.(Ex. Bco. de Itl. y Río de la Plata).
Foreign financial institutions	* SADELMI-COGEPI Co. * ESGE Holding Ltd. Switzerland * Int. Gen. Elec. S!A. Switzerland	* Banca Com. Ital. SpA(controls 32 financing firms) * Bco. di Roma (controls 15 foreign firms) * Bco. di Santo Spirito * Banque europeene.	* Cía. Com. Internazionale S.A.R.L. * Inter. Holding Fiat S.A. in Switzerland * USSIFI S.A. Luxemburg	* Com. Itl. SpA.	* I.I.T. Panamá * Holding Techint	* B. Central S.A. (Spain) * B. Vital. España S.A. * B. de Fomento S.A. España	* Banque de la Cons. et des Trx. Pub. * B. Hypot. Europ. * Sté. de Banque et de Participations * Banque pour la Cons. S.A. Belgium * STé. Francaise de Investissements
Foreign equipment suppliers	* Gen. Elec. Co.	* IRI Int. perla Recons. Inds. (Italy) * Montecatini Edison SpA	* Fiat Machine Mov. de Terra SpA * Allis Chamblers U.S.A. * Fiat Allis	* Fiat Machine Mov. di Terra SpA * Allis Chamblers U.S.A. * Fiat Allis			

Source : Tables V.1 and V.5.

Local Subsidiary	Parent Company	Firms Controlling the Group
Panedile Argentina S. A.	Instituto per la Ricostruzione Industriale IRI. (Controls approx. 510 companies: Industrial financial, construction firms.).	✯ Banca Comerciale Italiana SpA (controls 32 financial institutions (banks, credit org., etc.) ✯ Banco di Roma (controls 15 financial institutions) ✯ Banco di Santo Spirito. ✯ Banque Européene de Crédit a Moyen Terme (BEC), Belgium. ✯ Crédito Italiano SpA (controls 6 banks in England). ✯ Finanziaria Siderurgica (Controls Dálmine SpA). - Dálmine-Siderca S. A. Arg. - Andamios Tubulares Dálmine de Méjico. - Andamios Tubulares Dálmine de Venezueka. ✯ Soc. Italiana Per Condotte d'Acqua SpA (controls 61 construction and industrial firms); among them: - Caminos y Puertos S. A. Spain. - Condotte y Lodigiano SpA. - Impresa Centrale di Costruzionni SpA. - Taloro, Condotte e Lodigiani SpA. - Sedar, Switzerland. - Sté. St. Quen , France. - Soc. Francaise Condotte d'Acqua, France. - Panedile Argentina, S. A., Argentina.

	Motedison SpA (Montecatini Edison (controls approx. 240 companies: chemical, pharmaceutical, industrial, construction and financial firms.	✱ Costruzioni Impiante Elettrici SpA. ✱ Construcao e Exploracao de Instalacoes Elétricas e Telefónicas, Brazil. ✱ Carlo Erba SpA (Pharmaceutical) (Argentina subsidiary). ✱ Oleodotti Adratici Soc. SpA. ✱ Panedile Arg. S. A., Arg. ✱ Panedile Peruana, Peru. ✱ SADE, Finanziaria Adriática SpA. ✱ Costruzioni e Montaggi Fabbriche Riunite SpA. ✱ Banco Lariano SpA.
Dragados y Construcciones S. A.	Banco Central de España. (Private) (Predominant in 19 companies)	✱ Banco Popular Arg. (Arg.). ✱ Autopistas del Mare Nostrum S. A. Spain (Const). ✱ Banco Vitalicio de España S. A. ✱ Bética de Autopistas S. A. (Const.), Spain. ✱ Dragados y Constr. S. A., Spain. ✱ Material y Constr. S. A. ✱ Minero-Siderúrgica de Ponferrada S. A. ✱ Cía. Española de Petróleos S. A. ✱ La Cruz, Minas y Fund. de Plomo S. A. ✱ Española de Zinc S. A. ✱ Banco de Fomento S. A. ✱ Saltos de Nansa S. A. (Const.)
Supercemento S. A.	Banque de la Construction et des Travaux Publics (Predominant in 23 companies) France).	✱ Etablissement Financier de la Const. et des Travaux Publics (owns shareholding of Supercemento) ✱ Banque Hypothécaire Europ. ✱ Sté. de Banque et de Partic. ✱ Investissements pour le Dev. de la Const., Sté de (SIDC). ✱ Sté. Francaise d'Inv. Inm. et de Gestion. ✱ Banque pour la Cont. S. A. Belgium.

Neyrpic Argentina S. A.	Cie. Genérale D'Electricité S. A. (France) (Controls 210 companies throughout the world)	✱ In Argentina it is limited to Cogelec SAIC. Worldwide the group is predominant in firms which produce all kinds of materials for lighting networks, electromechanical and telecommunications firms. It is alsoolinked ti Alsthom Suc. Arg. which undertakes electrical and mechanical construction.
STUP S. A.	Enterprises Campenon - Bernard Europa S. A. , France (the main activity of the group is construction and development of technology in the sector).	✱ Societé Technique pour l'Utilisation de la Precomprente. It has construction firms established in some countries: - Empresas Campenon - Bernard STUP, Brazil -Empresas Campenon - Bernard (Venezuela) among others.
SADE S. A. ✱	General Electric Co.	✱ Cía. Generale di Elettricitá. Linked to : - A. E. G. Telefunken -Bull Co. -Osram GmbH.
Austin S. A.	The Austin Co. (USA)	✱ Austin Europe, France ✱ Austin Nederland, Holland ✱ Austin Deutschland GmbH, Germany ✱ Austin Process SpA, Italy ✱ Austin Italia, Italy ✱ Austin España, Spain.
Impresit Im-Pregilo Group:		
Impresit	Fiat SpA (Italy)	✱ Impresit Lavori Estero SpA Italy ✱ Imprese Italiane all'Estero SpA (Owns shareholding of Impresit) ✱ Ausiliaria Lavori Moncenisio SpA ✱ Impresit Lavori, Italy SpA ✱ USSIFI S. A., Luxemburgo ✱ Impresit Girola Lodigiani SpA

Impresa Umberto Girola	Impresa Umberto Girola (Italy)	✱ Costruzione Metropolitania SpA (SOCOMET) ✱ Costruzione Umberto Girola S. A. C. U. G. SpA. ✱ Impresit Girola Lodigiani SpA (Impregilo)
Impresa Ing. Lodigiani SpA	Impresa Ing. Lodidigiani SpA (Italy)	✱ Cofit- Ecuador ✱ Constructores Puente de Barranquilla, Colombia ✱ Gruppo Ponte di Messina SpA (Italy) ✱ I. L. C. E. Spa (Italy) ✱ Impresit Girola Lodigiani SpA (IMPREGILO) ✱ L. G. U. Lodigiani Gandini y Bandoni , Switzerland. ✱ Obras Hidráulicas y Varias S. A. (Spain) ✱ Place Moulin SpA ✱ Taloro Condotte y Lodigiani ✱ Techint, Lodgiani, Pipelines SpA (TLP) Italy.
A. G. Mc Kee and Co. S. A.	Arthur G. McKee & Co. U. S. A.	✱C. T. I. P. Compagnia Técnica Industrie Petroli SpA, Italy - C. T. I. P. Tractoniel Benelux Belgium - Mc Kee, CTIP GmbH, West Germany -Mc Kee CTIP Ing. S. A. Spain - Mc Kee CTIP Int. Inc. U. K. -Mc Kee CTIP Int. Inc. USA -Technique Mc Kee CTIP Cie France ✱ Mc Kee Pacific Pty. Ltd. Australia ✱ A. G. Mc Kee do Brazil Ltd. ✱ A. G. Mc Kee & Co. Canada ✱ Briones, Mc Kee S. A., Chile ✱ BUMAC Ing. y Const. S. A. de C. V. México. ✱ A. Mc Kee de México S. A. de C. U. ✱ Mc Kee Intercontinental, Panama.

Rodio S. A.	Solexperts Societé Anonyme Switzerland	✱ Ing. Giovanni Rodio y Co. Impresa Costruzioni Speciali SpA, Italy
Vianini Dragaggi Lavori Marittimi Suc. Argentina	Vianini Dragaggi SpA, Italy	✱ Construcciones Vianini S. A. - Argentina ✱Vianini Dragaggi SpA, Italy ✱ V. M. Corp. USA
Sociedad Comercial del Plata S. A.	Motor Columbus A. G. Switzerland (Controls 39 firms worldwide)	✱ Cía. Italo Arg. de Electr. ✱ Adela Invest. Co. Luxembourg ✱ Energía Hidroelectrica Andina S. A., Perú. ✱ Fibracel S. A., México
	Schweizerische Krediton Stalt A. G. Switzerland (Controls 33 firms worldwide	✱ Banque Ind. et Com. de Credit, Switzerland ✱ Banque Italo-Belge, Belgium ✱ Banque de Tunisie-Tunisia ✱ Crédit Suisse (Bahamas) controls part od shareholding of Sociedad Com. del Plata. ✱ Elektro-Watt Elektrische und Ind. Unternehmungen A. G. (controls29 firms worldwide) ✱ Grands Magasins Jelmoli S. A. (Controls 43 firms worldwide) ✱ London Multinational Bank Ltd. England.
Societé des Grands Travaus de Marseille S. A.	Societé des Grands Travaux de Marseille S. A., France (controls 30 firms)	✱ Auxiliaire de Matériel des Grands Trav. de Mars. S. A. ✱ Cie. de Const. Internat. ✱ Estudos e Exiancao de Obras Brazil ✱ Etudes et Applic. de la Précontrainte ✱ A. Janin & Co. Ltd. Cont. Canada ✱ J. Lain Const. U. K. ✱ Eurafrica Bau Gam. West Germany ✱ Cie. Financiere et Ind. des Autoroutes (COFIROUTE)

The firms which operate in other areas were left out of the sample, in order to make clear the kinds of vertical and financial linkage of each multinational construction corporation which operates in the country. For fuller information, the reader can refer to the publication mentioned.

Chapter VI. Company Agreements, Subcontracts and Profit Appropriation

In the previous chapter we analyzed the reasons which in our opinion, determine which subsidiaries may hold a certain degree of hegemony in the market, and this allowed us in practice to describe a large proportion of the entry barriers, always taking as the main feature the origin of the firm's capital. However - it is necessary to emphasise this - the existence of clearly differentiated advantages like those described does not necessarily exclude similar behaviour by large firms. It is true that several foreign subsidiaries currently show the highest relative turnover levels and that they are also significantly higher than the rest. But it is also likely that there are aspects of behaviour common to all large firms, whatever the origin of their capital. Several pieces of evidence lead us to believe, a priori, that this is so. One of them appears almost constantly in the statements made by chambers of commerce or federations which state, as if it were a daily occurrence, that the sector firms are considerably affected by the instability of demand. But it is also feasible that these market fluctuations do not affect all firms in the same way: those most affected are probably the firms unable to adjust their work plans to the time available or those who have less negotiating power. It is not an exaggeration to infer that the smallest firms will remain in this group almost permanently, while for the rest the effect will probably be less -independently of their nationality -. This difference inevitably leads us to study the first feature of behavior, perhaps similar in all of the larger firms, which is the company response to the erratic nature of demand.

This is not, however, the only point they have in common. Price-fixing methods can also make firms develop the same mechanism in order to guarantee a higher profit level. Each firm's ability to respond will naturally depend on its negotiating power in the market, which may be reflected in its degree of linkage, or its capacity to subcontract from a more favourable negotiating position than other firms.

Essentially, these are features which allow a differentiation of firm on the basis of their size. Though there is also a common element in the legal mechanism of labor contracting, which determines much company behaviour and therefore the means of capital accumulation at the micro level. If we accept demand instability as valid, we would consider, at the risk of being very superficial, that construction firms theoretically have four alternatives: first, to equip themselves to a level that allows them to carry out the work volumes which appear in the market at periods of peak demand, with the obvious risk that they periodically have a high level of idle capacity. Second, they could subcontract jobs, thus reducing their possible over-expansion; third, maintain a flexible equipment endowment which enables them to move from one submarket to another; and fourth, adjust themselves to the changing rate of demand by constantly varying the number of their employees. If they choose the last alternative - whether as basic policy or in conjunction with one of

previous ones - construction firms should exert pressure in order to guarantee for themselves a legal mechanism which will allow them to adjust their employment level without the changes having any significant effect on their costs. This feature is common to all firms, whatever their size or origin, although it is obviously not one of the main variables affecting company behavior.

Another possible behavior, resulting from the special characteristics of the sector are company agreements, either to overcome fluctuations in demand or to neutralize possible competitive effects which tend to create oligopolic situations guaranteeing greater market stability; an additional point which leads us once more to differentiate firms according to size. Of course, only large firms can make agreements which will have any effect on the market, while for the rest it is likely that their implementation only responds to a need to achieve greater similarity to the larger firms and will not substantially modify the general patterns of behavior.

This overall description obliges us to analyze in practice each one of the behavior variables which reflect common features in supply, according to the size of the firms. For this reason, in this chapter we shall study four of them in particular: first, company response to the erratic nature of demand; second, the ways in which profits or surpluses are appropriated - especially those which arise because of vertically linked structures and job and labor subcontracting -; third, the kinds of company association, and finally the ways in which financing is carried out at company level, in order to find out if the differences in behavior can be explained by the origin of capital or by relative size.

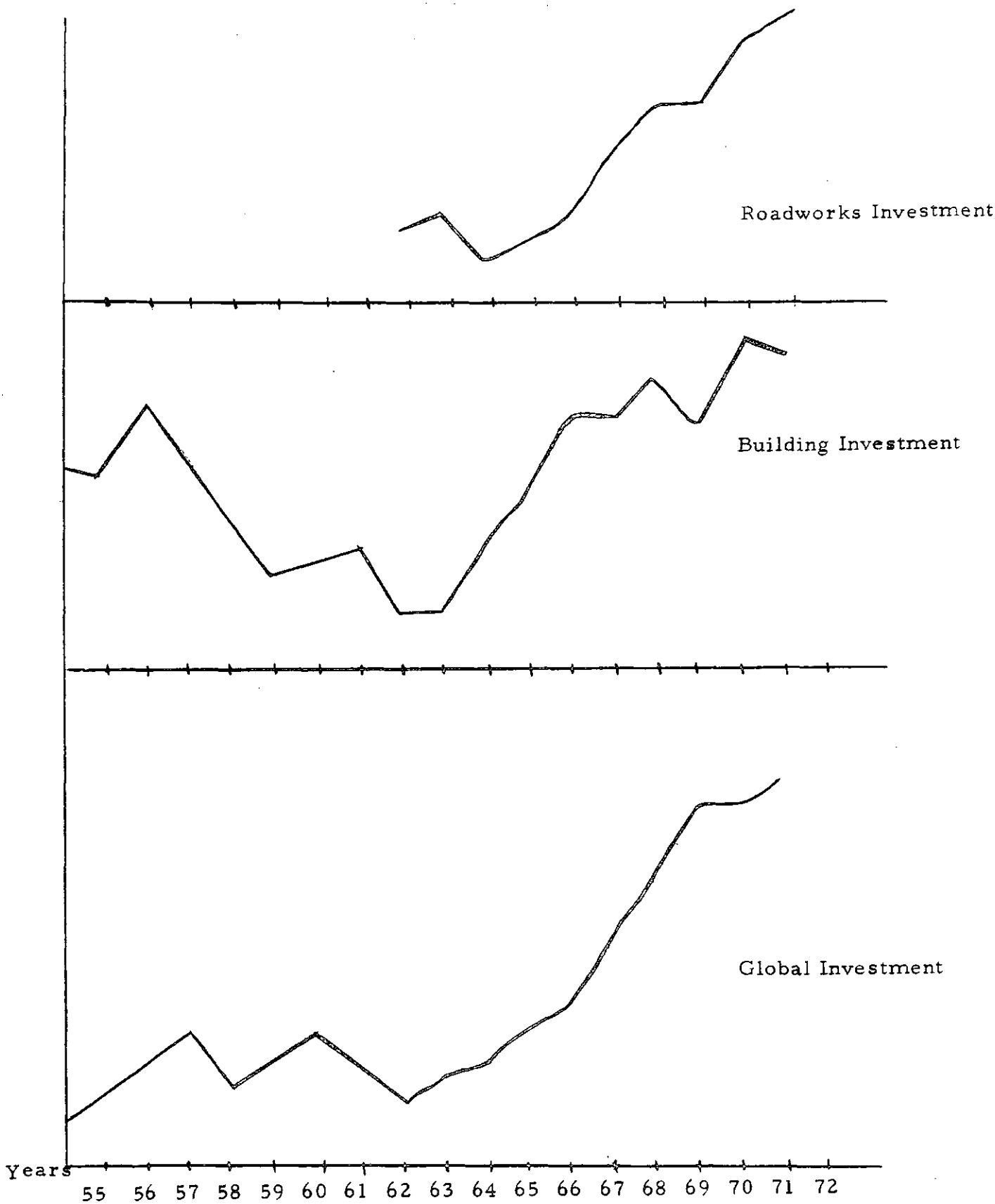
1) Erratic Nature of Demand

At the aggregate level, the fixed gross domestic investment in construction followed a significantly different pattern of behavior in the 1955/73 period from that of each one of the sub-markets. The overall data show that, with the exception of 1959, 1962 and 1963 the total investment in construction showed no sharp falls. In the 1963/72 period, for example, it increased steadily, although rates differed. On the other hand, at the level of each sub-market, the fluctuations in investment were significant, and considerable variations were registered in relatively short periods (Graph 1 and Appendix 1, Tables VI.8, VI.9 and VI.10).

This feature of the sector - relative continuity at the overall level and fluctuations according to type of construction work - necessarily affects company behavior, which differs in practice according to the size of each firm and their capacity to adjust their technical and organizational structures to the fluctuations of each individual sub-market, which is reflected in four aspects in particular:

a) In the capacity of firms with the highest relative turnover value to contract

Graph VI 1
Investment in Constructions



projects lasting several years, which allows them, unlike the smaller firms, to maintain a permanent stock of projects in their portfolios, ans thus cover themselves against falls in demand.

b) By difference in capacity to distribute costs over time, since the firm which can overcome fluctuations in demand by contracting long-term projects can minimize the idle capacity of its equipment and thus reduce the effect on its fixed costs. On the other hand, the relatively smaller firms may be the most seriously affected since they are unable to organize their work plans and distribute their fixed costs in a rational manner.

c) By the ability to choose the timing of public tenders. This advantage, arising from the previous points, is the result of the fact that a firm which has a permanently full works portfolio can plan its price quotations according to the different prices in the market and not based on its need to cover its fixed costs, - whatever the supply price may be - . For firms with a smaller contracting capacity, the situation is different: they must quote at any and all times independently of the price structure - and are able to bid below the market price as long as they cover their fixed costs.

Finally d) By diversifying their equipment. The fluctuations in demand in each sub-market mean that a firm which specializes in a particular kind of construction work is quite unable to cover itself when demand is low because it is not underwritten by an ability to move from one sub-market to another. Only firms which have managed to diversify their equipment can do so, and thus achieve a situation in which their annual maximum contracting values continue to rise in relative terms (or do not show abrupt falls). This can be seen fairly clearly in the firms with a higher turnover level, and specially foreign subsidiaries (Table VI.1). Logically, the financial capacity demanded by equipment diversification means that this response may only come from relatively larger firms. A large proportion of company specialization is due to the limited size of firms, and those who carry out a single type of construction works do so, not in order to increase their specialization, but because of their lack of technical and financial ability to move from one sub-market to another 135/.

In this respect, both this point and the previous ones show that the different degrees of stability of the larger firms (Chapter II) is basically due to a greater ability to adjust their technical and organizational structure to the changing rate of demand. The contrast with firms of a smaller relative si-

---

135/ Despite this, large firms with an apparent degree of specialization can be identified (A.G. McKee, Desaci, Field Argentina and Jaime B. Call, among others), although in practice they are perhaps the exception which proves the rule.

Table VI.1 Works Portfolio of Contracting Firms

Firm	Kind of Work	% of Total Turnover 1972/73
Techint S.A.	- Polyducts and other constructions - for YPF	52.9%
	- Civil works for the Secretaría de Aeronáutica	8.4%
	- Electromechanical works	7.8%
	- Roadworks	18.5%
	- Industrial works	1.9%
	- Others	10.5%
SADE. S.A.	- Electromechanical works for YPF	29.3%
	- Lighting networks	37.0%
	- Others	33.7%
Impresit Sideco S.A.	- Roadworks	33.5%
	- Port Constructions	10.8%
	- Grain Elevators	3.5%
	- Industrial works	27.6%
	- Others	4.6%
Dragados y Const. S.A.	- Hydroelectric works	89.0%
	- Building works	11.8%
Panedile Arg. S.A.	- Hydroelectric works	69.2%
	- Roadworks	30.7%
Novobra S.R.L.	- Roadworks	21.0%
	- Industrial works	72.0%
	- Others	7.0%
EACA, Empresa	- Roadworks	75 %
	- Electromechanical works	15 %
	- Sporting works	5 %
	- Others	5 %

Source: Balance sheets and author's research

* Estimated percentages

ze is marked, since in some cases these suffer from sharp fluctuations. Furthermore, they are the firms whose turnover always varies to a greater degree, as we can see in Table VI. 2.

If we take as an example the variation in the contracting rates shown between 1974 and 1975, we shall notice that it is in the sub-market where demand declined (roadworks) that the largest "losses" of contracting capacity appear. The variation towards negative values is greater here, while in the remaining sub-markets (which showed an increase in their demand: housing and electro-mechanical projects) the largest fluctuation is towards positive values. In other words, the firms operating in the sub-markets where demand decreases, suffer more. But the permanent feature, regardless of the level of demand, is that loss or gain in contracting capacity is always greater for small or medium-sized firms than for large ones. That is, the latter have a greater level of market stability.

Table VI. 2 Variations in the Rates of Maximum Annual Contracting Capacity
(1975 compared with 1974)

Minor Market	Size of Firms	Limits of Variations of Capacity Values assigned by Public Works Registers (★)		
Buildings	Large	- 10.8%	a	+ 6.9%
	Medium	- 86.0%	a	+ 111.8%
	Small	- 96.7%	a	+ 100.0%
Roadworks	Large	- 51.0%	a	+ 50.6%
	Medium	- 100.0%	a	+ 72.9%
	Small	- 92.9%	a	+ 76.4%
Hydraulic and Electrical works	Large	- 7.9%	a	+ 5.9%
	Medium	- 32.6%	a	+ 76.4%
	Small	- 43.6%	a	+ 64.5%

(★) The values represent increases or decreases in the maximum contracting capacity of the firms which the Banco Central de la República Argentina takes into consideration in order to estimate the sector's total production value.

2) Ways in which Profits or Surpluses are appropriated

It is absolutely necessary now to examine two of the ways in which surpluses are appropriated in the sector: the first one is based on links between construction firms and material suppliers. The second occurs through subcontracting different stages of a project and the temporary staff employed on them.

a) Appropriation of Surpluses through Links between Construction Firms and Material Suppliers.

Since public works tenders allow adjustments on the basis of higher costs 136/, the mechanism normally employed by construction firms to minimize the effect of inflationary processes on their real profit rate is that of increasing the expected input costs when the tender is submitted. In this way, they incorporate the inflationary component into the initial cost of the project, minimizing the risk of loss of profits. This situation has a different effect according to the degree of linkage between firms. For example, those which operate independently can only maintain their profit rate by increasing their tender price in relation to the amount of expected inflation; on the contrary, vertically linked firms can cover themselves by their group maximization capacity, submitting lower prices because they are not obliged to cover themselves against inflation. This happens because they are able, through their dependent firms, to internalize price differences during the course of the construction work, which is reflected both in a greater ability to win work contracts and in the underwriting of alterations in the price structure. On the other hand, linkage itself can produce discriminatory practices, since, when dependent supplies normally participate in oligopolic market structures, they are able to fix differential prices in relation to other construction firms. Essentially, they can "recuperate" their profit rate through their de facto monopoly (since they control the purchases of the dependent firm), by increasing prices over the market mean and thus re-establishing an apparently lost profit.

This situation can be seen by analyzing the gross operating surpluses of various building firms in relation to their dependent suppliers. Because of the kind of links, it is natural that the latter should be precisely those who have achieved a higher rate, while their parent companies in some cases showed appreciably lower rates (Table VI. 3).

136/ See Chapter V, section 4.

Table VI. 3 Gross Operating Surpluses

Nature of the Company and the Kind of Market in which it operates	Gross Operating surplus in relation to Sales
Company which constructs special foundations, dependent on a foeign firm	86.6%
Construction firm, parent company of the former. (Carries out engineering projects)	23.2%
Construction firm with no vertical linkage. (Carries out roadworks)	38.1%
Supplier of pre-moulded materials, dependent on a construction firm.	53.2%
Construction firm which owns the former. (Carries out engineering projects).	27.9%

Note: We consider the gross operating surplus (GOS) to be the difference between sales-wages-purchases. The rates which appear in each case are the result of the ration $\frac{GOS}{S}$.

Source: Author's calculations from information supplied by the Registro de Inversiones Extranjeras and compared with company Balance Sheets (1973).

b) Appropriation of Surpluses through Subcontracting Stages of a Project.

The differences in levels of maximum contracting capacity can lead, in conjunction with the erratic nature of demand, to the development of a method of intercompany profit appropriation.

The firms equipped to carry out projects lasting several years are able, in critical demand periods, to subcontract some of their jobs, thus acquiring additional profit based on the different market prices existing in rising demand situations as against critical periods. In general they are firms which contract when the demand dimension allows them to submit high prices, since it is a period in which a significant number of firms

probably have their contracting capacity filled with projects which begin precisely in that period. On the other hand, when demand falls, a significant number of firms have a higher idle capacity and must accept direct project contracts a price which will barely cover their operating costs. This difference between the real tender price and the subcontracting price is what in fact allows the appropriation of an additional profit, in relation of course to the difference in levels of contracting. In Graph 2 we show this process in a demand curve for building services over time, in order to gain a general idea of the cycles which permit differential prices 137/.

This situation is repeated in the cases in which tenders are made in "block of by a group". A project for the building of a housing complex may, for example, link together simultaneously in the same tender, the construction of sanitation works, urban paving and lighting. The contract holder can subcontract some of the jobs and obtain an additional profit if different price structures (at the periods of adjudication and subcontracting) are favourable to him. This naturally depends on the negottiating ability of each of the parties. 138/.

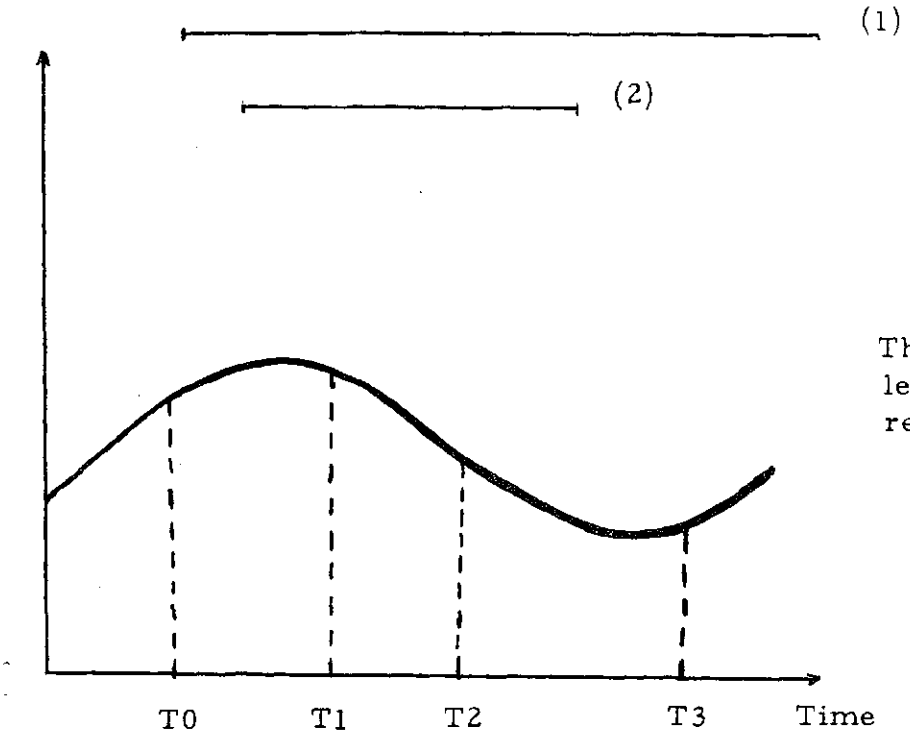
But price differences are not the only incentives for subcontracting. In some cases, for example, firms delegate some of their jobs in order to avoid excessive expansion. It is feasible that if a firm undertakes a specialized job (which does not fall within its principal sphere of activity), it may have to set up a new structure or division which may possibly require a high level of investment. If there is no certainty that it will be able to make permanent use of the investment, it will tend to delegate the job in order to avoid possible

---

137/ One of the restrictions on this mechanism arises from the final dates the customer usually fixes for completion of a construction work. Although the contract holder is the person who plans the subcontracting, the moment in which a job is delegated naturally depends on a program of jobs timed so that it cannot always coincide with two situations in which price differences favour it. The determining factor constitued by the client naturally restricts the degree of freedom and therefore the possibility of making an inter-company profit.

138/ One of the elements which favours subcontracting between firms arises from the way in which tenders are called for some public works. In the electro-mechanical sphere, for example, the civil engineering works are usually linked with the electro mechanical works by means of all-inclusive contracts (which may resemble turnkey agreements). The Cámara Argentina de la Construcción itself requested the breakdown of the two kinds of construction on 17th March, 1975. (See "Informaciones de la Construcción" for the same date).

Graph VI. 2



Theoretical demand level and mean theoretical profit rate

T0 T1 Presentation of firms with high contracting capacity

T2 T3 Job subcontracting

1) Time taken for execution of projects which can be carried out by firms with high contracting capacity

2) Time taken for execution of projects carried out by smaller firms.

future idle capacity. If subcontracting can be carried out at times when it is feasible to make an inter-company profit, there is naturally a further incentive. In any case, by delegating, it almost always reduces its total short-term working capital as it minimizes its possible future idle capacity.

Another kind of subcontracting arises when a firm linked with a building group calls on its dependent firms or on firms with which it maintains a permanent commercial relationship 139/. This kind of subcontracting differs from the previous one, since it is based on a criterion of market depnedency. Since the contract holder monopolize the jobs of a specific project, he can assign different stages at his descretion, favoring company groups with which he has formed oligopolic agreements. This kind of subcontracting usually occurs between large firms, so that, from another point of view, they minimize the possible effects of fluctuations in demand by complementing each other through their contracting values.

c) Surplus Appropriation by Labor Subcontracting.

In Chapter II we noted that levels of labor subcontracting have fluctuated around 70% of total employment in this branch of industry. The very nature of the building process makes the demand for labour differ, in absolute terms, in the different stages of a project. This happens mainly in housing construction or in the execution of long-term road and power works, while for other projects subcontracting is carried out according to the work programmes of each firm.

This temporary nature of employment has caused the development of methods of contracting which in practice involve an effective reduction of labour costs, with the resulting effect on profit levels. "The special situation in the industry", says Vásquez Vialard. "caused a proliferation of co contractors, sub-contractors and intermediaries, which hire work gangs at so much per pieza or square metres in order to avoid complying with social welfare regulations" 140/.

This kind of situation to a large extent was brought under the protection of the labor legislation which came into force under Law 17.258, 1967. Its main aim was to substitute for the permanency system which had applied

---

139/ For example, Impregilo contracts out part of the electro mechanical works to SADE or the foundations to Gesonda; or A. G. McKee contracts directly the services of SADE of Techint (or forms Joint Ventures with them).

140/ Vásquez Vialard, op. cit. p. 146

until then (Law 11.729 and its amendments) a more flexible one, by establishing instead of a dismissal indemnity, a salary to be held over and deposited in a savings account in the worker's name. In this way the permanency system which covered all work relations was replaced by an "unemployment fund" and company activity was also began to be regulated by compulsory registration of all employers with a Registro Nacional de la Industria de la Construcción. Several lawyers argue that, from technical point of view, the law has "serious defects"; they base their criticism mainly on two points: first, the fact that it designates "as an unemployment fund something which is only a salary that is held over" and, on the other hand, because "it does away with the principle of protection against arbitrary dismissal which was enshrined in Article 14 a of the National Constitution" 141/.

Vásquez Vialard also states that "it is undeniable that these new regulations, which claim to establish specific work standards, violate the constitutional precept which establishes protection against arbitrary dismissal" 142/. Others who have analyzed the legislation and have reached a similar conclusion state that "the law invests all work relations with a degree of instability, and gives significant benefit to the employer, since it replaces protection against arbitrary dismissal with an unemployment benefit which is no more than a wage that has been held over" 143/.

On the other hand, the same law has only limited application, since it covers only those in temporary employment, and not the permanent staff of a firm, such as its technical personnel, supervisors or administrative employees. An evaluation carried out in 1973 calculated that approximately 90,000 workers have benefitted from the law; this figure 144/, compared with the effective level of employment for that year (674,000 people, of whom approximately 480,000 were temporarily employed) means that slightly more than 80% of temporary staff were not protected by the law, simply because they were not legally registered (possession of work papers, for example).

141/ op. cit. p. 442 and 443.

142/ op. cit. p. 444.

143/ Carlos V. Corach, "Teoría y Práctica de la Ley 17.258. Fondo de Desempleo de la Construcción.". Derecho Laboral 1970; Reynaldo Luccini, El Nuevo Regímen Laboral para los Trabajadores de la Industria de la Construcción, Derecho Laboral, 1967.

144/ Cirilo V. Ghizzoni, Relación Jurídico Laboral entre los Trabajadores y Empleados de la Industria de la Construcción, Buenos Aires, 1973, mimeo.

This level of instability in work relations and the nature of the law itself allow employers to operate with a considerable degree of freedom in making up their work gangs, since in relative terms the cost of dismissal is less. Since the unemployment fund is made up of 4% of the basic wage fixed by labor agreement (plus an additional 4% for the first year of the contract) the indemnity a worker can receive for dismissal rarely exceeds 65% of his wage, since the average lenght of contract for unskilled workers is usually less than 8 months. If we accept that there is no warning system like that which exists in all other labour relations, it can be concluded that because of the intensive use of labor, the regulations in force allow a significant profit rate, reflected in labor relations in which temporary labor may receive below award wages, and be involved in a pattern of relations in which instability is the norm.

3) Types of Direct Company Association

a) In the public works market joint ventures are commonly formed in order to cover the minimum company capacity values required by different tenders.

This kind of association normally arises from two particular situations: first, because the total maximum capacity of a firm does not always cover a tender's requirements; and secondly, because it may happen that, although a firm is technically equipped, it must make its submission in conjunction with another, because part of its capacity is already covered by other projects. Due to the nature of joint ventures, these associations, are temporary and usually take the for, of a Limited Co.

b) A second form of association occurs because of a need to complement the equipment required for a construction work. Although it may be able to fulfil the capacity requirements of a public work independently, a firm might require very special equipment which it does not have available because of the kind of works it normally undertakes. For example, an urban paving contractor and a sanitation works firm might form an association if a construction work is tendered for jointly. A further example would be a firm which temporarily requires a larger volume of equipment than that available, but for whom it is not profitable to purchase such equipment, since it needs it only for limited periods 145/.

145/ Equipment complementation is one of the special characteristics of the construction industry, and differentiates it significantly from the manufacturing sector. Perhaps the closet example is that of agricultural production, where equipment is frequently hired out between productive units, but without a business association actually being set up for the purpose.

c) Associations formed to meet the "experience" requirements of a tender. This kind of association is usually seen in tenders submitted in block of jointly. For a project which involves, for example,, housing construction, lighting and sanitation works, the tender specifications may require the contractor to have accumulated experience in both kinds of work, for which a joint venture can be undertaken between firms specializing in each of the areas.

d) Association to fulfil legal requirements, When,due to thekind of tender, local firms are required to take part in a project, a joint venture is set up between them and others backed by foreign capital, in which the foreign group has a dominant position, reflected within the association by a majority capital share. This occurs in cases in which no local firm, either individually or in association, is able to carry out the project because of the type of background required.

A second kind of association formed to meet this kind of demand arises from the execution of binational projects, in which there may be local firms which are individually equipped to carry out an international project, but which must form an association with firms of the contracting countries because of the requirements set out in the tender specifications 146/.

e) Relatively permanent associations. A relationship seen between legally independent firms which have no linkage or capital participation (for example, Polledo S.A., Francisco Natino S.A., Petersen Thiele and Cruz A.A. and Crivelli Cuenya S.A., or A.G. McKee and Sade and Techint, among others) or between firms whose parent companies have direct capital links of common interests (in the case of multinational subsidiaries, this situation can be observed in the case of Techint S.A. and Elina S.A., Impresit Sideco and Supercemento, or Sade and SADE-Obrelmec).

Personally, we consider that the kind of association has two likely explanations: one of a technical and organizational nature, since the firms can achieve greater continuity and stability in the market when they have access to more projects of greater volume, so that they tend to assign their resources better

---

146/ An example in this respect is the building of the Fray Bentos-Puerto Unzué international bridge, in which Argentine and Uruguayan firms associated (EACA Empresa Argentina de Cemento Armado and Soler S.A.), because of a legal requirement. On the other hand, the building of the Salto Grande dam provides an example of an association between a firm backed by foreign capital (Impregilo and its local subsidiary Impresit-Sideco) and two firms from the countries contracting the project (Sollazzo Hnos. S.A. and Alvaro Palenga S.A.) also because of a condition in the tender.

and optimise them at group level, since they eliminate duplication of equipment and idle capacity. The other is based on the actual division of work between different firms, which enables them, in critical periods, to subdivide the volumes of work they contract as individuals and thus reduce the effect of their fixed costs 147/.

4) Financial Analysis of the Firms in the Sector.

As a final aspect of the variables which explain company behavior, we have included the analysis of three financial ratios arising from the balance sheets of the 40 firms whith the highest relative turnover. These are:

1) the $\frac{\text{total credits}}{\text{Sales}}$ ratio, which shows the magnitude of sales credits, or in other words, the percentage of credit which the firm grants to clients; 2) the net financial balance, through the $\frac{\text{total credits}}{\text{total debts}}$ ratio, which provides information about the amount of credit granted by a firm in relation to that which it received from third parties; and 3) the coefficient of indebtedness, $\frac{\text{total debts} + \text{financial}}{\text{total assets}}$ cover, which shows that part of a firm's assets financed from foreign sources.

From an analysis of this information we have found no significant differences between firms which undertake engineering projects as compared with those involved in housing construction, nor between local and foreign firms. It is likely that these kinds of differences between the group of firms analyzed and firms of smaller relative size, in which case the explanatory variable would be size 148/.

147/ Parallel to the study of the different kinds of company association, we also examined some of the behaviour related to the way work contracts are assigned, because we were convinced we could find associations lasting only for the contract period. During our work, we gradually became aware of imperfections relatively difficult to prove and perhaps more so to quantify. They are mainly connected with prior agreements for the submission of tenders (usually called accompaniment); oligipolic agreements to divide the market and imperfections in the clients themselves. It would, of course, have been extremely useful to have been able to have this information, since this kind of practice would seem to be common.

148/ Due to the difficulties involved in obtaining this information, we have analyzed only the 40 largest firms. Given the limited sample, we can note trends which are valid only for the relatively larger firms.

Nevertheless, we have detected small differences in the rates of indebtedness of the firms studied. For example, the coefficients $\frac{\text{total credits}}{\text{sales}}$ and $\frac{\text{total credit}}{\text{total debt}}$ are slightly higher for the 20 largest companies compared with the next 20 (Tables VI. 4 and VI. 5). There is no reason to doubt, then that the firm with the greatest financial capacity, expressed in this case through a greater capacity to give its clients credit (or which calls on its suppliers' credit to a lesser extent) achieves a better market position, in a way confirming the hypothesis that a firm with capacity to grant credit manages to gain larger shares in the market.

As can be seen, this analysis, which shows barely significant differences in the financial behavior of the first 40 firms, does, on the other hand, indicate significant differences if wecompare it with the ratios in 8 sectors or branches of industry (Tables VI. 6, 7 and 8), which suggest the following:

1) The construction sector, together with vehicle and machinery manufacture is the branch with the highest $\frac{\text{total debts financial cover}}{\text{total assets}}$ coefficient. Or, in other words, it has greater relative access to outside credit, since the percentage of other capital in relation to its own is considerable. The explanation can be found in the fact that the kind of product and process involved do not normally allow a high capital turnover, added to which there is also a low degree of liquidity.

A second way of approaching this point is through the relationship between client and contractors. Here we encounter a situation which is widespread : building is carried out by means of advances made periodically by the clients so that the final product price is arrived at, during the process of construction. This is reflected, in a construction firm's balance sheet, by a high coefficient of outside capital in relation to its own.

2) On the other hand, in the construction sector, both the percentage of customer credit, and the $\frac{\text{total credit}}{\text{total debts}}$ ratio (that is, the degree of credit a firm allows in relation to the credit it receives) are higher than for the other sectors analyzed (with the exception of the manufacture of electrical machinery and appliances, and stone, ceramic and glass).

The special feature of this situation lies in the fact that as well as the significant percentage of other capital with which construction firms operate, there is also a high percentage of credit granted to clients. This evidence, which would seem to contradict the previous point (that is, the fact that the clients finance the building process), in fact shows that construction firms act as intermediaries between the financial institution and the final purchaser of the

Table VI. 4 $\frac{\text{Total credit}}{\text{Total debit}}$ ratio

(Construction Sector)

Year	Position of Firms included in the first 40 in the Sector			
	1 -10	11 - 20	21 - 30	31 - 40
1964	0, 96	0, 97	0, 92	0, 86
1965	0, 99	1, 29	0, 80	0, 93
1966	0, 92	1, 11	0, 84	0, 78
1967	1, 12	0, 79	0, 99	0, 72
1968	0, 86	0, 83	0, 71	0, 64

Source: Drawn up from the balance sheets of the 40 largest firms in the sector.

Note: Each column gives the weighted average for 10 firms, taken from among the 40 largest ones according to their position in the overall ranking.

Table VI. 5 Total Credit ratio
sales
(Construction Sector)

Year	Position of Firms included in the First 40 in the Sector			
	1 - 10	11 - 20	21 - 30	31 - 40
1964	0, 60	0, 48	0, 53	0, 54
1965	0, 61	0, 67	0, 50	0, 47
1966	0, 55	0, 72	0, 52	0, 50
1967	0, 54	0, 58	0, 48	0, 53
1968	0, 60	0, 47	0, 60	0, 51

Source: Drawn up from the balance sheets of the 40 largest companies in the Sector.

Table VI.6. Total Debt + Financial Cover / Total Assets

Sector	Year 1964		1965		1966		1967		1968	
	1-10	1-40	1-10	1-40	1-10	1-40	1-10	1-40	1-10	1-40
1) Agriculture, levestock, forestry, hunting, fishing	0,57	0,41	0,50	0,43	0,47	0,39	0,39	0,36	0,38	0,34
2) Food products (excluding beverages)	0,55	0,51	0,56	0,54	0,63	0,58	0,57	0,54	0,54	0,51
3) Beverages	0,51	0,54	0,54	0,54	0,55	0,57	0,55	0,56	0,46	0,48
4) Textiles	0,48	0,53	0,49	0,56	0,50	0,55	0,47	0,51	0,53	0,50
5) Chemicals	0,53	0,52	0,50	?	0,45	0,48	0,41	0,48	0,37	0,43
6) Stone, glass & ceramics	0,36	0,45	0,41	0,46	0,41	0,49	0,38	0,46	0,33	0,39
7) Vehicles and machinery (excluding electrical machinery)	0,68	0,67	0,71	0,70	0,68	0,69	0,65	0,65	0,60	0,60
8) Electrical machinery & appliances	0,59	0,58	0,68	0,65	0,72	0,69	0,61	0,60	0,64	0,63
9) Construction	0,65	0,64	0,68	0,63	0,60	0,68	0,68	0,67	0,71	0,66

Source: idem Table VI.4.

Table VI. 7 $\frac{\text{Total Credit}}{\text{Sales}}$

Sector	Year									
	1964		1965		1966		1967		1968	
	1-10	1-40	1-10	1-40	1-10	1-40	1-10	1-40	1-10	1-40
1) Agriculture, livestock forestry, hunting, fishing	0,14	0,17	0,14	0,18	0,08	0,16	0,21	0,22	0,19	0,21
2) Food products (excluding beverages)	0,17	0,17	0,16	0,17	0,15	0,17	0,17	0,16	0,12	0,14
3) Beverages	0,17	0,20	0,20	0,20	0,18	0,17	0,15	0,16	0,17	0,16
4) Textiles	0,28	0,31	0,31	0,30	0,28	0,30	0,32	0,31	0,33	0,36
5) Chemicals	0,28	0,28	0,31	0,30	0,28	0,29	0,29	0,29	0,30	0,29
6) Stone, glass & ceramic	0,26	0,35	0,32	0,32	0,22	0,24	0,20	0,22	0,20	0,24
7) Vehicles & machinery (excluding electrical machinery)	0,32	0,35	0,31	0,32	0,30	0,31	0,35	0,34	0,35	0,34
8) Electrical machinery & appliances	0,81	0,71	0,78	0,65	0,52	0,46	0,46	0,42	0,[illegible]3	0,48
9) Construction	0,60	0,56	0,61	0,59	0,55	0,50	0,54	0,54	0,60	0,58

Source: idem Table VI. 4.

Table VI. 8 $\frac{\text{Total Credit}}{\text{Total Debt}}$

Sector	Year 1964		1965		1966		1967		1968	
	1-10	1-40	1-10	1-40	1-10	1-40	1-10	1-40	1-10	1-40
1) Agriculture, livestock forestry, hunting, fishing	0,53	0,61	0,52	0,58	0,47	?	0,74	0,66	0,70	0,66
2) Food products (excluding beverages)	0,54	0,55	0,46	0,50	0,40	0,46	0,44	0,45	0,33	0,37
3) Beverages	0,47	0,47	0,52	0,50	0,56	0,50	0,44	0,45	0,47	0,44
4) Textiles	0,70	0,66	0,31	0,30	0,72	0,72	0,66	0,63	0,67	0,65
5) Chemicals	0,69	0,71	0,98	0,86	1,03	0,84	0,97	0,77	0,90	0,82
6) Stone, glass & ceramics	1,05	0,87	1,39	1,06	1,06	0,78	0,96	0,72	0,91	0,78
7) Vehicles & machinery (excluding electrical machinery)	0,57	0,58	0,62	0,60	0,69	0,65	0,68	0,66	0,75	0,72
8) Electrical machinery and appliances	0,82	0,84	0,79	0,80	0,75	0,80	0,63	0,69	0,68	0,74
9) Construction	0,96	0,95	0,99	1,01	0,92	0,94	1,12	0,94	0,86	0,89

Source: Idem table VI. 3.

APPENDIX

Table VI. 9 Investment in Construction
Millions of Pesos at 1973 Prices

Year	Total	Private	%	Public	%
1955	17,230	12,631	73.3	4,599	26.7
1960	20,396	12,462	61.1	7,934	38.9
1961	21,301	12,837	60.3	8,464	39.7
1962	19,151	12,011	62,7	7,140	37.3
1963	17,908	10,540	58.9	7,368	41.1
1964	19,257	12,021	62.4	7,236	37.6
1965	19,712	13,054	66.2	6,658	33.8
1966	21,656	14,420	66.6	7,236	33.4
1967	22,792	14,785	64.9	8,007	35.1
1968	26,531	16,646	62.7	9,885	37,3
1969	29,255	18,371	62.8	10,884	37.2
1970	32,325	19,767	61.2	12,558	38.8
1971	33,225	19,090	57.5	14,135	42.5
1972	33,803	17,754	52.5	16,049	47.5
1973	29,060	17,020	58.6	12,040	42.4

Source: Plan Trienal

Table VI.10 Investment in Construction

Public and Private Sector - 1950/1971 Series
(in millions of 1970 pesos)

Years	Total Investment	Public Investment (**)	%	Private Investment	%	% I. N. V. P. B. I.
1950	2,416	853	35.3	1,563	64.7	5.8
1951	2,552	722	28.3	1,830	71.7	5.9
1952	2,442	832	24.1	1,610	75.9	5.9
1953	2,230	1,165	52.2	1,065	47.8	5.1
1954	2,374	1,562	65.8	812	34.2	5.3
1955	2,684	1,486	55.4	1,198	44.6	5.6
1956	2,666	1,201	45.0	1,465	55.0	5.4
1957	3,026	1,195	39.5	1,831	60.5	5.8
1958	2,769	1,015	36.7	1,754	63.3	5.0
1959	2,445	224	9.2	2,221	90.8	4.7
1960	2,192	241	11.0	1,948	89.0	3.9
1961	2,245	196	8.7	2,049	91.3	3.7
1962	2,310	227	9.8	2,083	90.2	3.9
1963	1,980	168	8.5	1,812	91.5	3.4
1964	1,986	211	10.6	1,775	89.4	3.1
1965	2,326	316	13.0	2,010	87.0	3.4
1966	2,537	423	16.7	2,114	83.3	3.6
1967	2,957	316	10.7	2,641	89.3	4.1
1968	2,931	437	14.9	2,494	85.1	3.9
1969	3,119	530	17.0	2,589	83.0	3.0
1970	2,909	543	18.7	2,366	81.3	2.5
1971	3,310	1,070	32.3	2,240	67.7	

(**) Besides the Secretaría de Vivienda and the Banco Hipotecario Nacional, it includes investment by the Banco de la Provincia de Buenos Aires

Source: Secretaría de Estado de Vivienda

Table VI. 11 Roadworks
(Expenditure and Investment by the Dirección Nacional de Vialidad)

Years	Total at 1973 Prices	Investment in Projects %	Maintenance Expenditure %	Expenditure on Administration & Acquisition of Equipment & Tools %
1963	1,377.81	67.7	17.0	15.3
1964	1,555.91	61.4	19.7	18.9
1965	1,052,31	54.0	23.9	21.2
1966	1,273.31	54.2	24.9	20.9
1967	1,510.81	57.6	22.7	20.7
1968	2,351.71	69.9	13.7	16.4
1969	2,850.61	78.2	10.0	11.8
1970	2,860.11	71.5	11.1	17.4
1971	3,672.51	76.2	8.5	15.3
1972	3,952.81	78.8	8.0	13.2
1973	4,067.72	71.8	13.0	15.2

Source: Dirección de Vialidad

product 149/. A situation characteristic both of housing construction and large infra-structure works, where the tender specifications demand that the contractor should have financial endorsement in order to guarantee the project's progress. This role of intermediary allows the firm to carry out its activities with a high percentage of outside capital, but with relatively less capacity to grant credit to its clients.

149/ This can be observed in the ratios themselves, since in most cases the $\frac{\text{total credit}}{\text{total debt}}$ ration is always near to 1. (Table VI.8). That is, debts are usually contracted to finance credits granted to clients (preferably as an advance on the work certificates).

PART II

TECHNOLOGICAL CHANGE

Technological Change

INTRODUCTION

Generally speaking, the studies which have analyzed the behaviour of the technological variable in various branches of the manufacturing sector have concluded that multinational firms base some of their advantages (in each of their markets) on an apparent technological superiority. In these cases, the flow of foreign technology has predominated over local developments, so that in a great many sectors domestic technology has been of a subordinate and adaptive nature 150/.

Methodologically, these studies take as their starting point a basic division arising from the origin of the technology, on the natural assumption that technological change in a country is directly linked to the rate of local research and development and to the flow of technology received from abroad, whether incorporated into the capital goods it imports or in the form of plans, formulas or engineering designs 151/.

Because of possible chain reactions between the various economic sectors, any analysis which attempts to evaluate the nature of technological change in any one of them must naturally study a priori the relative weight of each of the flows and the multiple interactions which occur in it. If such chain reactions do take place, it will be valid to believe in the case which concerns us here, that the kind of change which occured in the manufacturing sector also influenced the construction industry and affected its development. This basically leads us to inquire if the nature of technological change in the construction sector resembles that described at the aggregate level or not.

In order to examine technological change, we have chosen to analyze three kinds of indicator arising both from the results of research and development and from the inputs used. These are: the statistics referring to expenditure on research and development (RD), information on patents and data on the origin and nature of major innovations 152/.

150/ See, for example: J. Katz, Importación de Tecnología, Aprendizaje Local e Industrialización Dependiente, ITDT-CIE, Buenos Aires, p. I. 3.

151/ According to J. Katz, both kinds of inflow determine the frequency of incorporation of new products and/or processes, and also the rate at which improvement of existing products and/or processes occurs. Op. cit., p. I. 3.

152/ For example, see: C. Freeman, The Economics of Industrial Innovation, Penguin Books, Great Britain, 1974, part one; several authors, The Platics Industry: A comparative Study of Research and Innovation, in National Institute Economic Review, N° 26, Nov. 1963, London, p. 33.

In this case, we shall work tentatively with these last two indicators, since it is relatively difficult to quantify expenditure on research and development with any degree of accuracy, because of the nature of the construction industry. Apparently this is a problem inherent not only in branches similar to those in our analysis; it can also be observed in manufacturing sectors in which it is relatively difficult to distinguish between expenditure which involves R & D and that which does not 153/.

The statistics indicating levels of expenditure on R & D involve - almost without exception - varying methodologies which show both the lack of a single criterion on which to base a reasonably suitable indicator, and the difficulty of carrying out interbranch comparisons, and even more so comparisons between countries.

In order to overcome this problem, several authors have attempted to define a framework which may provide, in the first instance, the elements which go to make up what could be considered R & D expenditure. According to Frascati's manual the criterion which "distinguishes R & D activities from those which are not lies in the presence or not of an element of novelty or innovation. When routine procedures are established, expenditure should not be classed as R & D, whereas when these procedures are discarded and new areas opened up, it can be called R & D" 154/.

If we accept this criterion as valid, we shall see that the special characteristics of the product "constructions" - particularly their individual nature - mean that every project potentially involves expenditure on R & D. This occurs for a large number of construction which require plans which only in rare cases have already been drawn up. Thatis, specification is required for a product unlikely to be mass-produces and even less likely to be copied exactly - although near copies may well be made. Since the production process does not always involve routine problem-solving, we could be led to believe that R & D expenditure is being incurred.

153/ The manual produced in the city of Frascati (Italy) by a group of experts shows, for example, that an important part of R & D may be carried out by research personnel or institutions. Also by Research and Development teams which do not always work exclusively on their main activity. This naturally makes it difficult to draw up reasonably reliable statistics, a fact reflected in their conclusion that "R & D is not what R & D institutions do". OECD, Proposed Standard Practice for Surveys of Research and Development. DAS/PD/62.47 p. 13. See also C. Freeman, op. cit. p. 37 .

154/ OECD, Frascati Manual, Op. cit. p. 16.

However, not every project requires a new system, since there are certain stages which are standard practice. The main problem is where to make the distinction between different kinds of operation: that is, it is difficult to decide whether or not problems are routine. In the case of manufacturing industry, when a new model or product is designed, its development costs are classified under R & D expenditure. In such cases, it may be pertinent to ask whether the design of a new model or product 155/ involves R & D activities, whereas on the contrary, such a question might be inappropriate if a dam is being planned. In principle it is valid to argue that both kinds of construction work require R & D expenditure - in varying degrees - although for the construction sector the central problem is to identify which work (or kind of work) requires such expenditure. This is because each one - since it is unique - requires at the very least a plan, whereas, in the manufacturing industry, which involves mass production, these problems tend to be fewer 155/. In other words, the difficulty of identifying these costs makes any set of statistics which does so relatively open to error.

For this reason we have decided not to use statistics 156/ and shall concentrate in our analysis on the remaining indicators: the information concerning patents, and data on the origin and nature of major innovations.

155/ One can think of the launching of a new model car, new combinations of already known inputs to make a new product and other examples.

155/ In the construction sector another problem tends to arise in projects already under way, when a lack of materials makes regional substitutes necessary. Expenditure on an "urgent" study for such a substitution is difficult to identify, since it is generally included in the overall work cost, under operating expenditure. In the case of roadworks, two of the most important local adaptions have resulted from this kind of substitution: chalk-sand-asphalt surface and gravel-sand-asphalt foundation.

156/ This is in spite of the existence of sets statistics which show a low level of expenditure for the sector, although there is rarely a clearly defined methodological criterion. For example, statistics for the construction sector in England estimate R&D expenditure of the order of 0.1% of total sales. That is, practically non-existent, although this is apparently due the fact that the costs attributed to the execution of the project were not analyzed or broken down as possible R & D expenditure.

Chapter V I I . Patenting in the Construction Sector

In technology-creating countries the volume of domestic patenting has been considered one of the most appropriate indicators for quatifying technological output. Jacob Schmookler has shown that the number of patents for new inventions granted in the United States correlates significantly with both the number of workers involved in technology (scientists, engineers and skilled workers and supervisory staff employed in the different branches of manufacturing industry), and expenditure on research and development 157/. Thus we can conclude that changes over time in the comparative volume of patenting in different industries, or within each one of them, may reasonably accurately reflect variations in each sector's technological activity.

This argument, based on the study of technology-creating economies, loses some of its validity when we analyze the volume of patents registered in technology-importing countries. There are two reasons for this, inherent both in the subordinate nature of their technological development and the role played by patents in company strategy to capture and control markets.

On the one hand, the number of patents for processes or products registered by foreign individuals or firms prevents the use of the total volume as an appropriate indicator of domestic R & D, unless it is first broken down according to the origin of each patent.

On the other hand, since each patent is no more than a legal document which grants the holder "the exclusive privilege of carrying out a particular productive activity, of selling or importing duly specified products or processes; its entry in the local register does not mean that any kind of technological transfer has taken place, but simply that a legal monopoly over its manufacture and marketing has been set down in print" 158/. In other words,

---

157/ Jacob Schmookler, Invention and Economic Growth, Harvard University Press, 1966, Ch. II., pp. 41-47. An analysis of the conclusions of this study can be found in Jorge Katz, op. cit. Ch. IX, pp. 15 & 16.

158/ C. Vaitzos, Patents Revisited (mimeo), Secretariat of the Andean Common Market, 1971; taken from J, Katz, op. cit., p. IX. 90. When an inventor registers his new developments, he can do so by describing the basic features of his invention in very vague terms, since there is no explicit obligation to do otherwise. That is, the new invention cannot be reproduced simply from the description in the patents register. It is therefore valid to assert that the registration of an invention is in no way a transfer of technology, but merely the expression of a legal monopoly which grants the inventor the right to manufacture or market his new product or process.

the volume of domestic patenting covers both domestic R & D and the multinational corporations' strategy to control foreign markets by means of a legal monopoly. Thus, the same indicator covers two phenomena with radically different connotations.

Nevertheless, if we break down the volume of patents according to the origin of the inventor, and thus quantify the proportion originating from domestic sources, we can regard volume as an appropiate initial indicator for evaluating domestic R & D activities, and there appear to be no reasons to invalidate it 159/.

On the basis of this premise, in this chapter we shall attempt to describe the patents registered for each kind of work makingup the construction industry as a whole. Although the information from the patents' registers is classified according to a different criterion from the one we have used in our study (since the classification includes products and processes belonging to several sub-markets) 160/, we have been able to break it down into 6 kinds of works and products which can be tentatively included in the classification

---

159/ It is true that there are two limitations inherent in the overall patenting system. On the one hand, not all technological innovations are patented, since in some cases there is a fear of disclasing the information, because of the danger of copying once it is made public. On the other hand, a quantitative analysis of the volume of patents does not give us a clear picture of the degree of technical progress, since innovations with a different technological content are given the same importance. That is, statistically a patent for reinforced concrete has the same importance as one for a new design of ceramic blocks. This kind of limitation can only be overcome by working with individual patents and by using new information which allows the extent of technical progress to be quantified. In practice, this will be the criterion we shall use in our study, in order to minimize the effect of these weaknesses.

160/ The classification used by the Departamento de Patentes de Invención (15 different groups and 175 different classes) has several disadvantages, arising both from the way it is defined and the way it is implemented. The first is partly due to the confusion which exists between type and use of the patented product or process. In some cases it is classified according to type (for example the mechanical group - class 51 - includes rock, earth and tunnel drilling machinery, among others), while the same product can also be classified according to its use (for example, the civil engineering group - classes 83 and 89 - again includes mechanical construction equipment, but this time according to use).

Another disadvantage lies in the fact that several kinds of construction work are classified together (for example, class 99 includes both building construction systems and piles used in bridge or dam construction). A further disadvantage, the reverse of the previous one, is the spread of the same kind of product

used in Chapter IV 161/.

Within this framework, we shall attempt to analyze three ascpects: first, the development of patenting for each submarket, beginning at the start of the century; second, the proportion of domestic patenting in relation to that by foreign firms and individuals; and finally, its effect on local technological ability.

---

or component over a number of subclasses (for example, class 99 includes wall construction systems, while similar patents can be found in class 96 which includes concrete blocks). These disadvantages create classification problems, since similar products or processes can be found in different classes. In our study, in order to reduce the effect of these disadvantages, we have worked at the individual patent level. This allowed a new classification to be worked out which in practice gives wider scope for analysis. For an overall critique of patent classification, reference can be made to the studies by J. Katz, op. cit., p. IX.25 and IX.26 and J. Schmookler, op. cit., pp. 20 and 21.

161/ From information from the Dirección de Propiedad Industrial, up-to date as at April, 1976, we have reclassified patents in the Civil Engineering, construction and Scientifica Instruments group into the following kinds of project: a) Paving Construction; b) Bridges; c) Dams; d) Canals and Maritime Constructions; d) Housing; and f) Sewers and Drainage Systems. Our methodology for selecting patents was to count only those which are classified in the groups directly linked to the construction sector. For this reason, of the fourteen groups into which the register is divided, we have considered only the seventh, which covers patents relating to civil engineering, construction and scientific instruments. We have also taken into account only those classes (each group is divided into classes) which are directly related to the construction sector, ignoring those which cover scientific instruments. This methodology has led us to reject all patents, even though relating to products used in any kind of construction, if they have been registered in a group other than the seventh. We have, in fact, carried out a simplified search although it will be clearly seen throughout the chapter that this process has allowed us to obtain clearer information about each sub-market, and we beleive that this methodology does not invalidate the conlcusions we have reached.

I Patenting by Types of Project.

From Table VII.1, in which we have listed the volume of patents for systems, materials and equipment used in paving construction 162/, it can be seen that between 1880 and 1975 there were two clearly differentiated stages which correspond to a significant change in what was patented: on the one hand, until the Second World War most patenting related to building systems, with a stage from approximately 1920 to 1940 when patenting of materials or components increased, but without altering the general trend. On the other hand, from 1940 on, the process is reversed and patenting of road building equipment becomes more important within the overall picture, at the same time as the percentage of building systems falls markedly.

The first stage, which ends with the Second World War and was associated with a higher level of patenting of construction systems, occured at the same time as the beginning of large scale road construction in this country, Its volume was connected with a period of domestic learning and the need to adopt new techniques or processes which would allow larger-sized projects to be undertaken. The cost of research and the way in which it could be carried out during the construction process itself, for example) allowed domestic technology to develop, since after the first experimental work, new systems were possible, created by individual inventors in direct contact with the construction stage of projects. The same thing occured with respect to the components or materials for paving. Up to 1930, for example, patenting of components was mainly limited to new blocks (paving stones, foundations, etc.), which involved minor innovations, since they only reflect new designs or introduce new substances into already known components. Therefore, in this first stage, when road construction is carried out with semi-craft techniques, the level of domestic research and development, measured by the number of patents registered by local inventors, is higher than in the following periods.

162/ This information was gathered from class 83, which includes patenting of "roads , streets, paved surfaces, macadam, pavements and similar constructions. Machines, components and accesories used for their construction and maintenance. Materials and substances, etc. to prevent dust on roads etc. Machines, materials, etc. for the construction and maintenance of canals and ditches (except class89); materials utilized in the latter to produce a flow of water including special materials for its conservation. Mechanism and materials for the installation of pipes in public thoroughfares". *Text of* Class 83. Law N° 111 of Patents for Inventions.

Table VII. 1. Volume of Patenting of Systems, Materials and Equipment relating to paving Construction

	1880/ 89	1890/ 99	1900/ 09	1910/ 19	1920/ 29	1930/ 39	1940/ 49	1950/ 59	1960/ 69	1970/ 75
Systems	10	10	11	21	49	48	14	9	13	12
Paving components (paving stones, blocks, etc.)	4	1	4	6	22	23	5	11	19	28
Road building equipment and parts	-	5	7	10	14	20	17	39	51	38
Total	14	16	22	37	85	91	36	59	83	78

Source: Drawn up by the author from information obtained from the Departamento de Patentes de Invención. (✱)

This process coincides exactly with a change in the origin of patents when there was a significant drop in the number and percentage registered by local inventors. (Tables VII. 2, 3 and 4). (In Tables N° 5, 6 and 7 we have the same information broken down according to the country of origin of the patents.)

(✱) Except where indicated, all the tables in this chapter come from the same source.

Table VII. 2 Origin of Patents relating to Paving Construction Systems

	up to 1920	1920/1939	1940/1959	1960/1975
% of patents registered by local inventors	44. 2	43. 3	34. 8	32. 0
% of patents originating abroad	55. 8	56. 7	65. 2	68. 0

Table VII. 3 Origin of Patents relating to Paving Construction Components

	up to 1920	1920/1939	1940/1959	1960/1975
% of patents registered by local inventors	55. 0	28. 9	37. 5	34. 1
% of patents originating abroad	45. 0	71. 1	62. 5	65. 9

Table VII. 4 Origin of Patents relating to Paving Construction Equipment

	up to 1920	1920/1939	1940/1959	1960/1975
% of patents registered by local inventors	72.7	36.0	21.4	15.7
% of patents originating abroad	27.3	64.0	78.6	84.3

Table VII. 5 Countries of Origin of Patents relating to Paving Construction Systems

	Argentina	U.S.A.	Germany	England	Italy	France	Others
up to 1920.	23	13	3	1	2	4	6
20 - 29	19	16	3	2	3	5	1
30 - 39	23	10	4	4	2	2	3
40 - 49	3	4	3	1	1	1	1
50 - 59	5	-	2	-	-	1	1
60 - 69	3	6	-	-	3	-	1
70 - 75	5	2	1	2	-	-	2

Table VII. 6 Countries of Origin of Patents relating to Paving Construction Equipment

	Argentina	U. S. A.	Germany	England	Italy	France	Others
up to 1920	16	4	2	-	-	-	-
20 - 29	2	6	-	-	-	4	2
30 - 39	7	9	1	-	-	1	2
40 - 49	3	11	-	-	-	3	-
50 - 59	9	17	9	-	-	2	2
60 - 69	9	16	15	2	3	3	3
70 - 75	5	11	8	1	1	2	10

Table VI. 7 Countries of Origin of Patents relating to Paving Construction

Components

	Argentina	U. S. A.	Germany	England	Italy	France	Others
up to 1920	11	3	1	1	-	3	1
20 - 29	10	8	1	-	-	3	-
30 - 39	3	16	2	-	1	1	-
40 - 49	-	2	2	-	-	1	-
50 - 59	6	4	-	1	-	-	-
60 - 69	12	4	-	-	2	-	1
70 - 75	4	8	2	2	7	3	2

The second stage, distinguished by a relative increase in patenting of equipment originating abroad, is connected with a period when the development of construction systems receives an impetus from state institutions responsible for roadbuilding 163/. Due to the nature of their functions, the results of their research was freely available, which to some extent reduced the number of patents for constructiom systems registered, thus producing a change in the trend shown by the indicator.

On the other hand, during this stage there was an increase in roadbuilding, covering larger and technically more complicated projects which required new equipment with a larger operating capacity than that which had existed up to the mid-forties. This process, which took place simultaneously in Argentina, Europe and the United States, stimulated the development of roadbuilding machinery through the research carried out by the large international manufacturers who patented the largest amount of equipment. In Argentina this was reflected in an increase in the percentage of patents registered by foreign firms, which thus attempted to form a market dependent on their processes and equipment, at time when import substitution was the basic policy.

The level of domestically-created technology was limited, according to the evidence of local patents, to minor improvements to equipment already available on the domestic market, without this having had any notable effect on the technological profile of the sector as a whole. From an individual analysis of patents, a qualitative change in their content can also be seen. In this second stage foreign firms patent large earth moving and compacting equipment, whereas during the previous period patenting by local firms related chiefly to smaller-scale equipment (manual compactors, for example) or marginal improvements which did not give their owner a monopoly control over the market. On the other hand, from the Second World War on, the large international equipment manufacturers increased their control over the domestic market, firstly through their exports, and subsequently by granting licenses to local manufacturers for the use of their processes, or by directly establishing their own subsidiaries 164/. Thus local technology was naturally influenced by the policies of the multinational corporations and there was logically a significant decrease in domestic patenting.

We can also observe this change in bridge and dam construction, and in a wide range of maritime and sanitation works. For example, patenting of bridge

---

163/ Here we refer not only to local institutions, but also to research carried out by foreign governmental institutions.

164/ This point will be treated more fully in Chapter IX.

construction systems and systems for anchorage and tensioning of cables systems registered by local inventors declined markedly from 1940 onwards (Table VII.8). However, patenting increases significantly overall from the fifties on, when prestresses systems began to be used, which substantially modified the traditional standards for bridge construction, replacing steel as the basic structural material. (Table VII.9).

This decline in local patenting occurs at precisely the same time as a technical change of considerable international importance; that is, the adoption of prestressed techniques for all kinds of construction work. The invention was developed abroad, and patented by the European firms owned the license and who entered the local market with evident technological advantages, arising partly from the same conditions as those imposed by public institutions, since they require all processes used in their projects to have been previously tested. It is for this reason that those who have developed and tested the process abroad are able to enter a market which itself imposes a clearly defined entry barrier. This happens even though the principles which theoretically would have allowed local development of new prestressed systems are relatively well known. However, local firms have usually opted to take out a license on the system instead of undertaking the costs involved in preliminary testing 165/. Thus all practical improvements were appropriated by the foreign patent owners, who in this way extended their control over the market, and imposed further restrictions on it, thus affecting the creation of domestic technology 166/.

One way of visualizing this process is by observing the series of patents registered by foreign firms, which continued to register improvements to their original patent, and were thus able to constantly extend the sphere of operation

---

165/ E.G. Hirschmann said in 1955 that Frnace, Belgium and England had been able to free their construction industries from paying foreign licenses by seeking new solutions to the problem of creating and maintaining stress in concrete, in order to remove the influence of international patents, (...) based on state support. E. G. Hirschmann, Funcionamiento de un Centro Informativo de la Constucción. Revista Construcciones N° 116, January, 1955, p. 271.

166/ We have analyzed prestressed systems more fully in Chapters VIII and IX.

Table VII. 8 Anchorage of Bridges and Cables . Origin of Patents

	up to 1919	1920/1939	1940/1959	1960/1975
% of patents registered by local inventors	80. 0	26. 6	0. 4	0. 5
% of patents originating abroad	20. 0	73. 4	99. 6	99. 5

Table VII. 9 Anchorage of Bridges and Cables . Volume of Patents

	up to 1919	20/29	30/39	40/49	50/59	60/69	70/75
Anchorage of cables, bridge supports and bridge and viaducts construction systems	5	10	5	6	20	30	9

of their licenses 167/.

Despite these series of patents among registered innovations, their number, if compared with other branches of manufacturing, is remarkably low. Between 1940 and 1975, for example, only 65 patents relating to bridge construction or cable anchorage were registered. That is, only two patents per year. But if we analyze each patent individually we shall observe that, in spite of their small number, they have exercised total control over the prestresses market. This follows from the fact that all firms which offer the market a prestressed process have based their advantages on a very small number of patents.

According to several authors, one explanation of this phenomenon lies in the individual size of each firm. Sercovich states, for example, that "the patents belonging to firms with a low turnover relate to inventions which are more significant than those belonging to large firms, although the latter hold more patents". "This", he says, "is related to the fact that smaller firms have fewer powers of manipulation (...) and less possibility of developing blocking patents than (do) firms with high turnover and wide-ranging technological and market strategies" 168/. If we consider the firms which have registered prestressed patents, we shall observe that they are all small firms internationally, despite their high technological ability. They have naturally registered their patents in order to exploit their technological advantages in the local market, but without needing to be holders of several patents at the same time in order to achieve this, as in the case of the chemical, communications or electrical industries 169/.

This feature of the overall volume of patenting is also related to two clearly defined trends connected with the origin and the way in which these innovations have been used.

On the one hand, there is a relatively close correlation between the origin of the capital which dominates the market and the origin of patenting in bridge

---

167/ This can be seen fairly clearly in the cases of Freyssinet (Stup), BBRV or Dywidag, for example. (Appendix I to this chapter). C. Freeman, referring to the plastics industry, says "that even innovator to remain in the lead and it will be in a better position to produce new and improved specifications for the material". Taken from C. Freeman et al., op. cit., p. 22.

168/ See Francisco Colman Sercovich, op. cit., pp. 194-195.

169/ See C. Freeman, The Economics of Industrial Innovation, Penguin Books, Gran Bretaña, 1974.

construction systems 170/. (Table VII.10). Until the mid-fifties, for example, a significant amount of local patenting was carried out by the German firms which dominated the construction industry (Siemens Bauunion and Geopé, among others, which registered their patents between 1930 and 1938). The same thing happened with the arrival of the Italian firms. Their process of expansion was also accompanied by an increase in patent originating with their parent companies (for example, the Societá per le Condotte Dácqua, share controller of Panedile Argentina S.A., registered its patents towards the end of the sixties; or Moradi which acts as adviser to the Italian firms - who did so during the fifties). It also comes as a surprise that patents originating in the U.S.A. have been irrelevant since 1960. One possible reason may be the lack of American firms in infra structure construction, which would in some ways confirm the correlation we described at the beginning.

The second trend which appears relates to the high percentage of patents registered by foreign firms which mainly offer engineering services by authorizing third parties to use their procedures. These patents originate in France (STUP, owner of the Freyssinet System), Germany (Dywidag), and Switzerland (through BBRV and Losinger), and the firms enter the market in two different ways: the French set up technical offices which market the services based on their patents, whereas the Swiss grant licenses to local firms 171/. By means of these procedures, they have managed to get their patents into use, even though in their countries of origin they are small or medium-sized firms. More precisely, they are firms with little possibility of directly multinationalizing their activities (although the capital volume per unit required is insignificant). That is, they succeed in getting their patent into use through licensing or direct technical assitance, which are their only ways of exercising any influence in the market. This is possible, because unless there are explicit demand conditions involved, it is unlikely that this kind of patent will prevent

---

170/ Purely methodological grounds under bridge building systems, we include cable anchorage and tensioning, although in practice these are also found in other kinds of construction works.

171/ See Appendix to this Chapter, where we give as examples details of information about a number of patents related to cable tautening and hydraulic project construction.

Table VII.10 Bridge and Cable Anchorage Construction: Origin of Patents

	Argentina	France	Germany	U.S.A.	Italy	Switzerland	Others
up to 1920	4	-	-	-	-	-	1
1920 - 39	4	3	6	2	-	-	-
1940 - 59	1	5	6	5	2	3	4
1960 - 69	1	8	7	1	7	5	2
1970 - 75	1	3	1	-	-	-	4

entry of new firms, since alternative processes can be developed which can perfectly well replace the patented ones 172/. In this respect, if any of these firms was not established in the country, or had not licensed its processes, it would be unlikely to affect the market, since it could be replaced by other firms with tested systems. This is the case with the Coignet Fench patents which, although registered since 1964, have had no effect on the use of prestressed systems in this country, because they can easily be replaced by those which operate locally.

The same features have also been reflected in patenting of canal and jetty construction systems (Table VII. 11 and 12) and of dam construction 173/.

172/ Daniel Chudnovsky, when expalining the role of patents in the industrial sector, says that "patents which are not utilized play an important preventive role, They not only protect the manufacture of the product based on a patented process, but also protect it against imports made by another firm. When international corporations patent products or production processes they guarantee a monopoly income, by preventing the production of the goods in question by other firms, and further more they increase that income, because they have at their disposal a means of stopping the marketing of the said goods by independent firms". D. Chudnovsky, Empresas multinacionales y ganancias monopólicas. Siglo XXI, Buenos Aires, 1974, p. 110.

173/ In the classification of the Dirección Nacional de Propiedad Industrial, this kind of works comes under class 91.

Table VII. 11 Canals and Maritime Constructions : Volumes of Patenting

	up to 1929	1930/39	1940/49	1950/59	1960/69	1970/75
Canals	5	1	2	3	7	9
Jetties and break-waters	1	1	-	6	7	1

Table VII. 12 Canals and Maritime Constructions: Origin of Patents

	up to 1920	1920/39	1940/59	1960/75
% of patents registered by local inventors	33. 3	20. 0	36. 3	12. 5
% of patents originating overseas	66. 6	80. 0	63, 6	87, 5

Two different phenomena can be observed in patenting for dam construction: on the one hand, a relative decline in domestic patenting (with the exception of the period 1929 to 1940) (Tables VII. 13 and VII. 14), and on the other, two clearly defined stages in total volume directly correlated with the major stages of dam construction in this country, which occured in the periods beginning in 1940 and 1965 respectively. (Table VII. 15).

Table VII.13 Dams: Origin of Patents

	up to 1920	1920/39	1940/59	1960/75
% of patents registered by local inventors	14.2	30.7	12.0	12.5
% of patents originated abroad	85.8	69.3	88.0	87.5

Table VII.14 Dams: Country of Origin

	Argentina	U.S.A.	Germany	France	Others
up to 1920	1	2	3	-	1
1920/29	3	2	1	-	-
1930/39	1	-	4	1	1
1940/49	1	-	-	6	3
1950/59	2	-	-	4	-
1960/69	-	1	-	4	-
1970/75	2	-	1	7	1

Table VII.15 Dams: Volume of Patenting

	1900/19	1920/29	1920/39	1940/49	1950/59	1960/69	1970/75
Dams and sluice gates	7	6	6	10	15	5	11

Generally speaking, the processes have been patented by firms involved mainly in hydraulic projects, and not by civil engineering firms, (see appendix), which indicates that the large contractors have achieved their advantages in the local market by using technologies which form part of their accumulated experience and organizational ability, and not by utilizing patented processes. That is, their construction ability and market performance spring more from non-technological advantages than from an ability to develop processes which can be patented and with which they could prevent the entry of competitors into the market 174/. This is due to the nature of the technology which, since it is based on freely disseminated scientific principles, limits the possibilities of patenting processes or systems.

Despitethis, those processes which have in fact been registered enjoy a similar situation to that described for bridge and cable anchorage patents. Although their number is limited, they have had considerable importance in the development of hydraulic works. For example, they include the Noetzli patents which between 1940 and 1955 were used for considerable number of construction works; or the Alshton and Neyrpic patents employed from 1950 onwards in a large proportion of the hydraulic works carried out on local dams (See appendix) 175/.

The final group we have been able to distinguish among infra structure projects is involved in sewerage and drainage works. We can see from Table VII.16, that in this area patents play an insignificant role, since the essential technology is incorporated into the components used in their construction, and not into the construction systems themselves. This is confirmed by the differences in the two kinds of patenting as since the beginning of the century there have been approximately 220 patents relating to drainage pipes 176/, where-

---

174/ In Chapter V we saw how the non-technological advantages of the multinational corporations have enabled them to achieve their present dominant market position, In this respect, the remarks concerning dam construction patents to some extent support the hypothesis we developed in that chapter.

175/ The Noetzli patents were used among other projects for the Cruz del Eje and La Florida Dams, while Neyrpic-Alshton carried out the hydraulic works for most of the country's dams, such as: C.H. Futalelfú, Ullun, Dique Florentino Ameghino, Chocón, C.H. Carrizal and the Nihuil III. See, in this connection, Memoria y Balance, 2° financial year to the 31 st December, 1974, of the above mentioned firm.

176/ Drawn up from information in classes 86 and 96.

Table VII. 16 Construction of Sewers and Drainage Systems: Volume of Patents

	up to 1919	1920/29	1930/39	1940/49	1950/59	1960/69	1970/75
Sewers and systems for drainage construction	9	2	2	2	0	1	1

as only 8 construction systems have been registered. To some extent this bias shows that new technologies have been adopted through component substitution, and not from the use of new construction methods.. In other words, it shows that technical change originated from the suppliers of euipment and materials rather than from the construction firms themselves, which mainly played a passive role with regard to change.

Our analysis so far shows that the volume of patenting may be considered a reasonably appropriate indicator for the evaluation of domestic technological capacity for undertaking infra structure works. On the other hand, the same is not true of the building construction market, since the information from the Registro de Propiedad Industrial due to inherent classification problems 177/, does not allow the process of technical change to be perceived with suficient clarity.

177/ Among others, there are seven classes which include patents relating to processes or materials which can be used in building construction (85; 88; 92; 95; 132). The classification is rather disorganized and makes it difficult to study the information in a way similar to that relating to infra structure works. For this reason, we shall study the number of patents registered in classes 96 and 99 in aggregate form (they correspond reasonably well to the building construction sub-market), but as our main source we shall use the information gathered from the Dirección Nacional de Tecnología de la Secretaría de Estado de Vivienda, by means of its Technical Approval Certificates, which can be linked to patents for inventions.

Since the beginning of the century approximately 3408 patents were registered in classes 96 and 99, a significantly larger number than that registered for all infra-structure works. This does not imply that there has been a higher degree of absorption of technology nor that research and development expenditure has been higher. When we consider individual patents we observe that the general trend shows that innovations registered are for improvements in components or systems and do not involve a change of any importance in construction methods. That is, we find minor innovations which make it diffcult to consider the patent indicator appropriate for evaluating the rate of innovation in the building construction sub-market 178/.

This large number of patents reveals, on the other hand, a strange paradox; in the branch with least technological progress 179/, patenting has been significantly higher. This can be explained, in our opinion, by the connection between the appearance of new products or components and the possibility of developing alternative systems. When a new input or premoulded component appears, new systems are possibly developed combining these elements with the traditional ones. But in these cases the patents relate mainly to improvements, since the inventor merely makes a new combination of the inputs or components existing in the market. Therefore this kind of development provides a lower degree of innovation but is significant in number because of the many possible combi-

---

178/ Class 96 includes "artificial stones, concrete blocks, domes, tiles, bricks, sun-dried bricks, hourdies, paving stones, pipes, conduits, tubes and other articles made of concrete, artificial stale and other similar building materials. Their composition, combinations, applications, shapes, etc.; machines, apparatus and manufacture (except ovens for baking and class 24). Inflammable cloth. Boards and planks for making up and production". Class 99 includes "special building systems and foundations for various uses (except class 8). Construction of walls, silos, foundations, piling, sea walls and similar structures. Houses, special structures, roofs, sheds and similar structures (not included in other classes). Special methods for their construction. Kiosks and similar constructions. Masonry. Scaffolding, parts and similar structures. Piles, pillars, etc. (except those specially assigned to class 81); their construction, machinery and equipment for positioning them and methods of securing them (except classes 88 and 95)". Text taken from Patents for Inventions Law N° 111."

179/ See, among others, Revista Summa N° 69, Nov. 1973, Buenos Aires (special edition on Industrialización de la Vivienda en la República Argentina); Construction Industry, United Nations, UNIDO, Monographs N° 2; A. Santillana, Análisis Económico del Problema de la Vivienda, Ediciones Ariel, Barcelona, 1972.

combinations which can be made with these elements.

On the other hand, if we consider the information provided by the processes and products which have a Certificate of Technical Fitness granted by the Secretaría de Estado de Vivienda, we see that normally the methods introduced in this way have had slight application in the market, since they are limited by a rate of building which does not allow scale economies 180/.

If we study all the building methods granted aTechnical Approval Certificate, we can conclude that domestic patenting for housing has been stimulated by factors resulting from three variables: first, the appearance of new building materials; second, the emergence of new premoulded materials; and finally, the search for state financing, since a method approved by the Secretaría de Estado de Vivienda can be used for the latter's plans.

Perhaps this is the main objective of seeking a Technical Approval Certificate, since a firm which attempts to use a system or product which involving some degree of innovation can only effect payment of its work certificates when it has received technical approval. In other words, this kind of patenting is related to demand for greater technical security on the part of the customer (the Secretaría de Estado de Vivienda, in this case); this is achieved by making explicit from the outset which products of building methods may be used in the projects they contract.

So far we have analyzed individually the features of patenting for each kind of project coming under the building industry, but have not described overall patenting behavior in the sector, nor made a comparative analysis with the

---

180/ Technical Approval Certificates are granted by the Dirección General de Tecnología de la Secretaría de Estado de Vivienda y Urbanismo. In February, 1976, 612 certificates were registered, of which 329 were still valid. Their distribution was as follows:

Construction Systems

Light	Medium	Heavy	In Situ	Total	Materials	Equipment
49	30	24	34	137	149	43

Source: Dirección General de Tecnología, S. E. V. and U.

volume of patenting in the industrial sector. These are the main topics to be presented in the following section and will be discussed by way of general conclusion to this chapter.

II. Overall Features of Patenting in the Construction Industry.

In general, the first outstanding feature of almost all sub-markets is the progressive foreign takeover of patents. This process has occurred not only in the construction industry but has also tended to become general throughout all sectors of the economy, beginning with "the entry of the multinational corporations into the Argentine economy towards the end of the fifties" 181/.

In the construction industry this process is associated, as we have already seen, with the replacement of patenting of systems belonging mainly to individual inventors by patenting of components and equipment, coming in most cases from industrial firms backed by foreign capital. Thus, the use of essential processes which had to be tested beforehand allowed the volume of patents originating abroad to increase and inhibited local patenting, since the private markets for construction services were concentrated in the hands of the foreign owners of the processes. In other words, the local inventors had no "space" to develop and test new systems, since they encountered a market with strong barriers to entry arising mainly from the need to adopt already tested technologies.

Parallel, to this process, there was a reduction in the number of patents, as individual inventors became less important and the multinational groups increased their share 182/. According to Daniel Chudnovsky, this phenomenon "reflects the change which occured in the way scientific and technical knowledge is developed with the rise and consolidation of monopoly capitalism" 183/.

181/ Daniel Chudnovsky, Las Patentes de Invención, B. Aires, 1975, mimeo.

182/ This process, which also spread to the other industrial sectors (see Jorge Katz, op. cit., Ch. IX), can be seen more clearly in patents relating to cable tension, bridges and dams, than in that which relates to building construction. We have not been able to specify precisely the extent of this process, although the empirical evidence from the analysis of each of the classes demonstrates that it did in fact occur.

183/ Op. cit., p. 3.

Explanations with some degree of validity which have been suggested, emphasise the change which has occured in the nature of technological activity; the growing complexity of technology (in the case of buildings, the introduction of technically more complex works) and the need for teamwork using more expensive equipment all of which limits the possibilities of individual inventors 184/.

The starting point for this process is the relative differences in patenting between the different kinds of works. We have confirmed, for example, that the volume of patenting has been considerably greater in works which do not demand much technical background to understand the nature of their components or systems, or which do not require a high rate of expenditure on equipment in order to attempt to develop new processes, which naturally makes the work of independent researchers easier and facilitates the development of minor innovations, as in the case of patents related to building construction.

These relative differences in patenting between different kinds of works also have an inverse correlation with the supply structure of each sub-market. The highest level of patenting occurs, for example, in the sub-markets in which the supply structure is most fragmented, and in which the barriers to entry of new firms are insignificant, as can be seen fairly in the following table:

Table VII.17 Ratio between the Number of Patents and the Structure of Each Sub-market

Kind of project	The 4 largest firms share of the Total Value of of Production in Each Sub-market	Total of Patents
Building	6.6%	3,408
Roadworks (paving)	30.2%	521
Electro-mechanical (Dams)	46.3%	60

184/ In this connection see, among others, Jorge Katz, op. cit., p. IX 34 and 35, and C. Freeman and others, the Plastics Industry: A Comparative Study of Research and Innovation, in National Institute Economic Review, N° 26, November, 1963, London, p. 32.

One of the possible explanations for this phenomenon may be found in the analysis we made of housing construction. A larger number of individuals of firms connected with the making of a product may make it more likely for new inventors to appear, if the technology employed is relatively adaptable to new components or processes. Hence patented systems can be replaced by marginal modifications which in practice lead to a new patented process, but which can only be defined as a minor innovation. This is waht happens mainly in the patent for building construction or in a considerable number of patents for roadworks.

On the other hand, patenting for dam and bridge construction systems shows a completely different situation. On the one hand, these systems are used in a market in which the supply of building and technological services is relatively concentrated and in which clients demand that each system be previously tested in similar works. This situation gives a foreign firm advantages in the domestic market, by its using the patents system as a way of blocking the entry of new competitors. Even if the total number of patents is fairly low, the very fact of registering essential know-how tested abroad gives them a virtual monopoly over their market and the dissemination of these principles also facilitates the firms' expansion since it can indicate new uses of their processes.

Hence, unlike building construction, patenting in these cases prevents the entry of potential competitors, and local firms are faced with the dilema of risking indictment of their patents if they endeavour to compete with the multinational corporations, or having to pay further royalties to be able to use to new processes or products, even though the principles have been widely published in the market.

Appendix : Patents Relating to Hydraulic Works Construction (Dams)

Name of System	Inventor	Origin	Date of Registration	Period for which Valid	Patent Number
New holding dam	C. Cinca	Argentina	13.8.1914	10	11,477
Suspension dams	Peter Rutemberg	Germany	28.8.1914	10	11,507
Weir Mechanism	Maschinenfabrik A. Numberg	Germany	15.12.1914	2	11,793
Improvement to Dry Docks	D.E. Williams	U.S.A.	12.12.1921	10	17,415
Dams with dividing walls	A. Milano	Argentina	27.6.1924	5	20,030
Sluice gate dam	Vereinigte Stahlwerke A.	Germany	12.11.1932	15	38,966
Weir	Maschinen Fabrik Augsburn Nurbenger A.G.	Germany	29.7.1936	10	44,429
New kind of dam	Societé des Travaux de Marseille	France	5.7.1940	15	50,776
Procedure for Construction of Reservoir	E. Freyssinet	France	9.3.1949	15	70,482

Procedure for Works Exposed to Moving Water	Etablissements Neyrpic	France	27.2.1951	15	79,098
Improvements to Jetties and Dams	Neyrpic	France	27.2.1951	15	79,099
Artificial Blocks for Hydraulic Works Construction	Neyrpic	France	4.5.1951	15	79,932
Improvements to Jetties and Dams II	Neyrpic	France	17.6.1953	15	89,619
Sluice Gate Fastening Mechanism	Neyrpic	France	31.5.1954	15	93,758
Canal Regulation Mechanism	Neyrpic	France	26.1.1956	15	100,922
Lock for Hydroelectric Installations	Neyrpic	France	17.2.1956	15	101,211
Sluice Gate Improvements	Neyrpic	France	27.4.1956	15	102,249
Contracting and Expanding Joints for Dams	Pirelli SpA	Italy	25.2.1957	15	106,644
Dam	Compagnie Industrielle de Travaux	France	16.5.1958	10	112,581

Dam comprising at least one upper wall and one earth holding wall	Ballast-Nedam	Holland	4.9.1969	15	182.385
Sluice Gates	Alsthom	France	23.12.69	15	178,746
Sluice Gates II	Alsthom	France	20.1.1970	15	178,907
Mechanism	Alsthom	France	30.1.1970	15	178,323

Patents Related to Prestressed Systems

Name of system or product	Inventor	Origin	Date of Registration	Period valid	Patent N°
Anchorage procedure	E. Freyssinet	France	June 1941	10	52,254
Cable anchorage (endorsed)	E. Freyssinet	France	Oct. 1947	10	61,254
Improvements to Anchorage Mechanisms (supplementary to Patents N°s. 52,254 and 61,407)	E. Freyssinet	France	Feb. 1951	4	79,182
Anchorage	EACA - BBRV	Switzerland	Nov. 1959	10	119,474
Prestressing and Anchorage	EACA - BBRV	Switzerland	Jan. 1960	8	120,178
Anchorage	EACA	Arg. (Swiss	April 1961	15	125,278
Anchorage for prestressing framework	STUP ✱	France	May 1963	10	132,898
Iron beam anchorage	STUP	France	Oct. 1963	10	135,988
Anchorage Mechanism	Dywidag	Germany	Dec. 1963	10	137,271

Improvements to prestressing	E. Freyssinet	France	May 1964	9	139,012
Prestressed concrete for highways and streets	Dwidag	Germany	June 1965	15	144,655
Anchorage	Losinger A.G.	Switzerland	July 1968	15	162,189
Anchorage	Dywidag	Germany	Aug. 1968	15	162,434
Anchorage mechanism	STUP	France	July 1970	15	178,522
	Alsthom	France	8.9.70	15	179,295
	Alsthom	France	4.12.70	15	180,897

✱ STUP owns E. Fressinet's patent.

(1)

Source:

Chapter VIII. Major Innovations.

The overall volume of patenting shows that the level of domestic technology, as compared with the adoption of foreign know-how began to decline from the moment when increasing technical complexity gradually began to affect construction processes and individual inventors were "replaced" by the large groups or multinational corporations. This overall view naturally provides us, in the first instance, with a brief summary of the kind of technical change which has been developing in the construction sector, though due to the nature of the indicator it only shows the development of dependent know- how. It is likely that a significant number of technical advances have not been patented, but have entered the market as freely available technologies, Hence we must call on a second indicator of technical change, which may basically enable us to remove the bias inherent in the overall volume of patents data. It is for this reason that in this chapter we shall analyze the major innovations, which in practice relegate the problem of whether new developments are dependent or not to a minor position, and which may also enable new questions to be ansewerd.

In this case we shall attempt to answer five questions: The first concerns the origin of major innovations which will, of course, enable us to confirm or reject the conclusions of the previous chapter. The second question will help us to study technological lag; that is, the time from the first appearance of the innovation 185/ to when it is introduced into the local market. Thirdly, we shall analyze the rate of adoption of major innovations, which itself can be defined as the inflow of technology. We shall then try to identify the agents of technical change, in order to analyze the technological behaviour of both supply and demand. And fifthly and finally, we shall study the way in which processes, products or equipment which involve a major innovation are introduced. Strictly speaking, we shall attempt to show whether the technology was introduced through foreign licensing, or whether its adoption was due to local developments or the use of knowledge freely available internationally.

This analysis of the inflow of major innovations as an indicator of technological development, means that technical change must necessarily be described as a "stop-go" process. It obviously omits a large number of advances arising from an accumulation of minor changes, which combine to produce relatively

---

185/ We consider the moment the innovation appears to be its first commercial launching in the case of a product - or its first experimental use, in the case of a construction system or process.

important advances and alter the sector's technological profile 186/.

There are, of course, significant advances which produce "technological leaps". But it is also true that, from the moment they are discovered they are extensively studied and tested and in this way a significantly better knowledge of their characteristics and possible uses is achieved. This kind of innovation, built up over time, enables tender specifications of even the technical proposals to set down more rigid requirements (or new specifications) which may lead to an increase in factor productivity. Such technical improvement generally comes from a long process of laboratory research in materials testing or from experience obtained from carrying out different kinds of project which require different technical specifications. This kind of accumulation of minor innovations is seen mainly in the development of building systems or in changes in overall inputs utilized. Thus, the very fact of their accumulation may lead to new combinations of existing materials and processes. This combination of accumulated developments produces similar effects to those arising from a major invention which involves a real technological advance.

In fact, we may consider that this kind of innovation plays fairly important part in the changing technological profile of the sector. The inherent nature of the construction industry persuades us that this is so. But when we attempt to evaluate it, we are in practice faced by a problem of identification: the fact that there is a large number of these innovations and that they frequently arise from daily problem-solving, makes their analysis considerably more difficult. For this reason we have preferred, in this chapter, to study major innovations which, although they constitute specific changes, can offer us an approximate idea regarding the kind of technological change which has occured in the sector.

I. Major Innovations.

In order to identify major innovations we have used the "trial by jury" method. Thus, after a number of consultations with a variety of professional people working in the sector, and having gathered material from specialist sources

---

186/ A valuable discussion on this topic can be found, for example, in Nathan Rosenberg, Factors Affecting the Payoff to Technological Innovation, mimeo, Sussex, 1975. V. Ruttan, Usher and Shumpeter on Invention, Innovation and Technological Change in Nathan Rosenberg (ed.). The Economics of Technological Change, Penguin Books, England, 1971, pp. 73-85 and in Samuel Hollander, The Sources of Increased Efficiency: A Study of Du Pont Rayon Plants, The MIT Press, Cambridge, Massachusetts, 1965, p. 52, where technological change is defined as major of its development was considered problematical (...) before the program was undertaken.

we discovered 37 innovations which have been set out in Tables VIII. 1a and VIII. 1b 187/. The difference between the two tables is that the first whows the total process relating to the innovations: who was its original inventor, when he developed it, who introduced it into the local market and how. In the second one, on the other hand, we include those innovations for which we have only obtained information relating to the agent and the way in which it was introduced into the local market. That is, it shows only the way in which it was introduced into the domestic market and not how it was first developed - in those cases, naturally, which the two processes were different - 188/.

187/ In order to select major innovations we made a number of enquiries among engineers, architects and foremen of construction firms, searched specialist literature, consulted business associations (with the support of the Federación Argentina de la Construcción), public and private institutions (the Instituto del Cemento Portland Argentino, la Comisión del Asfalto and Lemit, among others) and public departments which contract civil engineering works (Agua y Energía Eléctrica, through the Comité de Grandes Presas and Obras Sanitarias de la Nación, for example). Logically, there may be different criteria which question to some extent the classification we have arrived at. Nevertheless, admitting its possible errors we believe that at the aggregate level it can be used as a fairly appropriate indication for assesing technological change which has occured in the sector as a whole.

188/ We have been able to complete the cycle referring to the year of development and of introduction into the local market for 21 of the 37 innovations. With regard to the remaining 16, we have studied only the year of their introduction into the local market and the institutions or firms which first manufactured or tested them. In fact, the columns relating to the first international development, that is, the dates of their first commercial launching and the original inventor, have been removed from Table VIII 1b and included in Table VIII 1a. In other words, the former only provides information on the introduction of innovations into the local market, and not the analysis of their initial development.

Table VIII. 1a

Innovation (Product of System)	Year of its International Discovery & First Commercial Launching	Inventor	Year introduced into the Local Market	How introduced into Local Market and by Whom
Portland cement	1824 (Yer of discov.)	Joseph Aspdin England (Inv.)	1875. First made (with limited commercial success). 1913/16 First large scale production	The first factory was established by the Comisión de Salubridad 1/, while in 1916 the Compañía Argentina de Cemento Portland of Lone Star U. S. A. was set up.
Reinforced concrete	1867. First Develop. & application 2/. The first time if was used in large constructions was in 1925 in Newcastle, by W. B. Wilkinson	J. Monier France (inventor) 3/	1900. (first Argentine patents) 1920/25 first Monier patents registered	The first Argentine patents were developed by Dr. Domingo Selva, while the Monier patents were introduced by the German firm Weyssy Freitag which obtained the rights for several countries.
Prestressed concrete	1928 (idea launched) From 1930, it began to be used in projects carried out by E. Freyssinet in France, Magnel in Belgium & Firsterwalder in Germany	E. Freyssinet	In 1949 the first experiments were carried out and in 1952 it began to be used in building construction, while in 1959 it was used in bridge construction.	The first experiment was carrried out in the Experimental Grounds of the Instituto del Cemento Portland Argentino, at the request of the firms of Acerbeton SRL & EACA which launched two processes developed in Italy (Massioni & Noli patents) and Switzerland (BBR patents) respectively.

Prestrss-ed concre-te	First used in U. S. A. in 1948			It was first used by the Belgian firm Blaton Aubert, using their Magnel patents to build the roofs of a motor factory (Talleres Eléctricos del Oeste).
Concrete Roadways (I) (solid paving)	1929 (theory developed) 1931/35 (first used)	Bureau of Public Roads & Highway Research Board U. S. A. 5/	1928 First concrete slap made for the Morón-Luján road Prov. of Bs. As.	The project for the first concrete paving was undertaken in 1927 by the Ministry of Public Works of the Province of Buenos Aires. 6/.
Concrete Roadways (I) (flexible paving) (Valor Soporte California C. B. P.)	1929 (theory developed) 1931/35 (first used)	Bureau of Public Roads & Highway Research Board (development theory) Civil Aeronautics Adm. (among others) first uses	1936 (first experiments) 1940 (first used)	Promoted by Dirección de Vialidad de la Provincia de Buenos Aires and the Instituto del Cemento Portland Argentino.
Rigid and flexible paving II	1951. WASHO Road Test 1958. WASHO Road Test	American Association of State Roadworks Employees U. S. A.	1953/60 Standards incorporated	Dirección Nacional de Vialidad among others.
Continuous frame slabs	1921 (first experimental use)	Launched by the Bureau of Public Roads, U. S. A.	1964 (first theoretical mathematical research completed) 8/	Promoted by Dirección de Vialidad de la Provincia de Buenos Aires and the Instituto del Cemento Portland Argentino.

Cement floor	1935 (first experimental section) 9/	Launched by the Highways Department of South Carolina, USA with the support of the Bureau of Public Roads and the Highways Research Board	1939/40 (first experimental stretch).	Promoted by the Administración General de Vialidad Nacional y the Dirección de Vialidad de la Provincia de Buenos Aires 10/ 11/.
Lime floor	1937/40 (first theoretical experiments).	(1937) N.I. Bykofski URSS) and (1940) Chester McDowell (U.S.A.) 12/ (1939) State Road Laboratory of Texas (USA)	1951 (first experimental stretch)	Promoted by Vialidad Nacional withtthe support of the lime manufaturers.
Fine cold asphalt	1923-26 (first developments)	Dr. Dammann (1923) Germany, and Carter (1926) of Constable Hart Co. Ltd., England	1953 (first launching)	Incorporated by Viani y Melloni SRL, under English standards of British Standards and by Shell Co. - The first tetsts were carried out in the LEMIT (Lab. de Ensayo de Materiales de Inv. Tecnológicas) del Ministerio de Obras Públicas de la Provincia de Buenos Aires.
Asphalt emulsions	1923 (first use) 13/	France	1935 (first commenrcial launching)	

Air entraining in cement	1920 (principles developed) 1931 by Hercules Powler Co. & Dewey & Almy Chemical, USA	Prof. Scholer USA inventor. 14/	1949 (first experiments) 1951, first application in the Punta Lara water treatment plant & in the Punta Lara aqueduct La Plata, Prov. de Bs. As.	The first test was carried out in Lemit, with Dr. Charles E. Wuergel, technical director of Marquette Lement Manuf Co. of the USA The first commercial launchings were made in 1950 by Silka SRL, using Swiss patents. and by Drogaco S.A. using the stadards of the American Society for Testing Materials (ASTM) which only accepted the products developed by Hercules Powler & Dewery & Almy Chemical 15/.
High resistance steels	1925/35	Austria, development of Isteg, Sigma & Torstahl steels 20/.		Aceros Sima S.A. Santa Rosa S.A.
Shells structures	1925. First experimental development 22/	Dyckeroff und Widmann A.G. Germany		
Sawing of joints	1940/45 (tests) 1945/50 (first commercial applications)	The first tests were carried out in the USA by the Highways Dept. of the states of Illinois & California. using saws made of abrasive material. It was first used properly by the Maint. Div. of the Roads Dept. of the State of Kansas, USA, in 1949 16/	1955/60 (experimental tests) 1960 (first used)	First used in a project in the concrete paving of the access road to Baker's portland cement factory. One of the promotors was the Instituto del Cemento Portland Argentino 17/

Neoprene joints	1933 (develop. of neoprene) 1958 (first used in road widening joints)	E. I. Dupont of Nemos Co., carried oout the first develp. in 1930/ 35. First used for roads by the Bureau of Physical Research, N. Y., Dpt. of Transportation USA 18/.	1968 (first commer- launchi ng of neopre- ne joints for roads)	Promoted by Pirelli S. A.
Processed cement plants	1916 (first co- mmercial launch ing)	U. S. A. Baltimore	1940/42 first used commercially (a failure) 1962 second commer- cial launching (success ful)	Introduced by the firm of LIPSA which closed down The second commercial launching was undertaken by Hormigones Argentina owned by the Lone Star. Co.
Graders	1919	Russell Co. USA (in 1928 it was taken over by Caterpillar Tractor Co.)	1968/69 first large scale production. First used in the twenties	Made by Astarsa, John Deere, Kockum and Siam with foreign technical assistance 21/.
Frontal mechanical spade	1937	Trackson Co. USA	1968/69 (first large scale production) First used in the forties	Made by Astarsa, Crybsa, Eximis, John Deere, Kockim, Nortorf & Siam, with foreign technical assistance 21/.
Expanded polystyrene	1942-1947	In 1942 it was launched by I. G. Farben of Germany and in 1947 by Dow Chemical of the USA	1959-1962	Introduced locally by BASF Argentina S. A., of Germany, by Ipako S. A. backed by American & French capital & by Monsanto of the USA

Exopi	1947/50	Launched by Devoe & Reynolds of the USA & CIBA of Switzerland 23/.	1955 (?)	Introduced locally by CIBA Argentina S. A. & Sika S. A., both backed by Swiss capital.

Notes Table VIII.1a

1) See Revista de Cemento Portland N° 14, March, 1947, Buenos Aires.

2) Some authors argue that reinforced concrete appeared in 1848 in France when Lambot made a concrete boat. However, it was developed significantly after Monier patented his processes in 1867, so that year may be considered as the biginning of reinforced concrete.

3) See K. Hegnel - Konyi, Hormigón. In Eric de More, Nuevas Técnicas en la Construcción - Librería y Editorial Alsina 1954, Buenos Aires.

4) The first prestressed bridge put up in this country was build over the Río Bermejo, in Manuel Elordi, Salta, by the firm of Zarázaga y de Gregorio, using Leonhardt German patents.

5) The technology for the construction of rigid paving has shown permanent development since 1920. The most significant developments were those carried out in 1925, by H. M. Westerdaerd, with the aid of the Bureau of Public Roads of the U. S. A. and the Bureaux of the States of Virginia (1930-36 and Columbia (1950). The last and most important piece of research is the A. A. S. H. O. Road Test, carried out between 1958 and 1960 in Ottawa, Illinois, USA. Raul A. Colombo, El Diseño. Pavimentos Rígidos, in Aporte de la Obra Vial N° 3, Cámara Argentina de la Construcción, 1965, pp. 39 and 40.

6) See Revista de Cemento Portland N°23, December 1950.

7) With regard to flexible paving, see for example, Alberto Lenne, El Diseño. Pavimentos Flexibles, in Aporte de la Obra Vial N° 3, Cámara de la Construcción, 1965, pp. 63-71.

8) Jaun F. García Balado and Mario E. Aubert, Pavimento de Hormigón con Armadura Estructural. Carreteras N° 65. January-March 1973, p. 15.

9) The original idea for concrete flooring belongs to J. H. Amies, who in 1917 patented his first mixtures, calling them "Soilamines", and to H. E. Broke Bradley, who in 1916/17 established concrete in cart tracks on Salisbury Plain, England, although in fact new theoretical developments were necessary for it to be used in practice. For example, R. R. Proctor's discovery in 1929 concerning the humidity-density ratio permitted definite control of compacting, which made experiments with concrete flooring possible.

10) The first experimental streches were made on the road from Azul to Las Flores.

11) Luis María Zalazar, in Tecnología para el Desarrollo de los Caminos Secundarios, explains the way experiments carried out in the United States become known. "In 1936, a commission from Estudios de la Dirección Nacional de Vialidad de Argentina made up of Drs. J. Allende Posse, E. Humet and E. Coll Benegas, travelled around the U.S.A. and the State of South Carolina, among others. They were very impressed by the work being carried out there in "concrete flooring"; therefore, experimental stretches were made in the Provincesof Córdoba and Buenos Aires in 1939". (Dr. Luis María Zalazar, Tecnología para el Desarrollo de los Caminos Secundarios, Asociación Argentina de Carreteras, Bs. As. 1975, p. 62).

12) Luis María Zalazar, op. cit, p. 69.

13) H. Añón - Suárez and D.C. Messaccesi, Experiencias Argentinas sobre Mezclas en Frío con Emulsiones Aniónicas. Carreteras N° 73, January-March 1975, p. 4.

14) After his discovery, he was contracted by Dewey and Almy Chemical Co. which monopolized the world market in concrete air-entrainers together with Hercules Powler until the mid-forties. See Henry L. Kennedy, of the cement division of Dewey, La Durabilidad del Hormigón; Revista Construcciones N° 42 and 43. November-December, 1948, Buenos Aires, and in Henry Kennedy, The Function of Entrained Air in Portland Cement Journal of the American Concrete Institute, June 1944.

15) See, among others, A.S.C. Fava - Teoría y Práctica de la Incorporación Internacional de Aire al Hormigón de Cemento Portland, Revista Construcciones N° 91, February 1952, Buenos Aires, and Henry L. Kennedy, op. cit.

16) See Henry D. Cashell, Trends in Concrete Paviment Design, Journal of the American Concrete Institute, April 1963, p. 507, and Alberto S.C. Fava, Juntas Aserradas para Pavimentos de Hormigón, Carreteras, Buenos Aires, January-March 1957, pp. 17-26.

17) See Camino de Acceso a la Fábrica Barker; Revista del Cemento Portland N° 54, April 1962,

18) Some studies argue that research into the use of neoprene in paving joints ended in 1964. On the other hand, there is agreement that it was the Bureau of Physical Research of New York which promoted them after carrying out a comparative study of 14 different stamps. See Informaciones, Cámara Argentina de la Construcción N° 311, 30th. January, 1971, p. 16.

19) See Revista Carreteras N° 64, October-December 1972, p. 18. Buenos Aires.

20) Juan F. García Balado, Acero de Alta Resistencia en las Estructuras de Hormigón Armado, Cemento Portland, N° 48, March 1959, Buenos Aires, p. 3.

21) See, among others, J. A. Brochiero, Equipos para Movimiento de Tierra Aporte de la Obra Vial, op. cit., pp. 75-84. This point will be treated more fully in Chapter IX.

22) See Revista Construcciones N°s. 42-43, November-December 1948. Buenos Aires. And Revista del Cemento Portland N° 4, February 1945.

23) Ch. Freeman, The Economics of Industrial Innovation; op. cit. p. 90, and the Use of Epoxi Resin Impregnation for Deteriorated Concrete Structure, paper by J. D. N. Shaw, published in Advances in Concrete, The Concrete Society, London, no date.

Table VIII. 1b

Product or System	Year of Introduction into Local Market (Manufa ture)	Firm or Institution (s) which introduced it and Origin of Capital	Way it was introduced	Comments
Light artificial	1966	- Arcillex-Laca Tenter S. A. Denmark	Direct capital investment and licensing of technology from parent company.	Tends to replace rounded edges. Improves thermal & acoustic insulation Reduces wieght of concrete.
Abestos concrete	1935-37	- Eternit S. A. (Belgium) -Monofrot S. A. (owned by Tamet France & taken over by Monofrot)	Direct Capital investment & technological licensing from tehir parent companies	
Concrete Additives (hardening accelerators & retarders; air incorporators, etc.)	1946-52	-Sika S. A. (Switzerland) -Drogeco S. A. (Argentina) - Indhor (Argentina)	Sika licenses all it sales to its parent company, whereas Drogeco used American stadards	
Plastic insulators		-Dow Chemical U. S. A.	Direct Capital investment	

Aluminium for buildings		-Kaiser Aluminio (U.S.A.) - Alcan - Camea	Direct capital investment	
Items made of PVC (pipes, plates, etc.)	1950-55	- Dunlop (England) - Fademac (France) - John Manville Co. (U.S.A.) - DPH S.A. (Argentina)	Direct capital investment and licensing of foreign technology: Fademac and John Manville from their parent companies and Dunlop from third parties via its parent company.	
Fibreglass	1962	-VASA (England-France) - Termac S.A. (Argentina)	Direct capital investment & licensing of technology from foreign third parties via parent company (VASA, licensing of foreign technology)	Used, for example for plastic sheets and as insulation. There are patents for its use in reinforced concrete, in place of round iron.
Concrete Foundations	1955	-Rodio (Switzerland)	Direct investment & technological licensing from the parent company	
Piles	1935	-Pilotes Franki (Belgium) -Vibrex Sudamericana (England)	Direct capital investment & foreign technological licensing. Vibrex used A. Hiley's English patent, while Franki took out a license from its parent co.	

Ceramic Slabs	1947-50	-Lateramerica SRL -Aedesnova Arg. SRL (Arg. -Italy) -Ladrillos Olavarría S. A. (Losa) (Italy)	Lateramerica manufactured them with outside technical assistance from an unassociated Italian firm	
Slidings Plank Mould	1954	-Concretos Prometo (Sweden)	Technological licensing from its parent company	
Cellular Concrete	1956	-Siporex Arg. SRL (Sweden) - SIHL S. A. (Argentina)	Siporex licensed the process from its parent company	Cellular concrete is obtained by chemical reactions using aluminium or calcium powder (or both together). For example, around the early fifties it was antieconomic to use luminium powder because of its high cost. Siporex, which used this method, stopped production after a short period 1/.
Centrifuged Concrete	1948	· SCAC, Sociedad de Cementos Armados Centrifugados S. A. (Italy).	Direct investment & technological licensing from the parent company (in the first stage of manufacture)	

Reinforced concrete structure for buildings of several storeys	1948	-Dirección Municipal de la Vivienda (state institution)	The Gaburr system tested in Italy in 1942 (patented) was used 2/.	The first tall building made with reinforced concrete floors was built by EACA in 1933
Tempered glass		-Vidriería Argentina S. A. (VASA) (England-France)	Direct capital inv. and technological licensing from the parent company	There are several tempering works (Santa Lucía Cristal S. A. y Cristales California, among others) which mainly use material produced by VASA. Santa Lucía Cristal owned by the Pilkington group, also has a license with its parent company for all its sales.
Metal plank moulds	1950	-Acrow (England)	Direct capital inv. During the First Stage of manufacture Acrow licensed technical assistance from its parent company	

Notes Table VIII. 1b

1/ See Hormigones Celulares, Revista de Cemento Portland N° 21, December, 1949.

2/ See Revista de Cemento Portland N° 15, April 1947, p. 16-18

From an analysis of Tables VIII. 1a and VIII. 1b it emerges that all the systems, components and equipment involving relatively important technological changes in local building processes have originally been developed abroad 189/. This conclusion reflects relatively clearly the way the major innovations were introduced and indicates, in the first instance, the subordinate and adaptive nature of a large proportion of the local process of technological change or, more precisely, the readiness of the sector to accept new foreign developments.

II. Technological Lag.

The degree of lag can generally be deduced from the difference in time between the first commercial launching of an innovation or its first foreign testsand its introduction into the local market. In this case we have ascertained that the lapse of time has varied markedly according to which kind of institution or company produced the invention abroad and which local agent introduced it. When the development was promoted by foreign public institutions, the technological lag was normally less than when the innovation was developed in private industrial firms. In the latter case, the lag was of approximately 19 years; that is, more than double that which occured when the invention was carried out or promoted by state institutions. This can be confirmed in the following table:

Table VIII. 2 Technological Lag

	Average Lag	Minimum & Maximum Lag
First developments promoted by foreign public institutions	7.1 years ✱	4-15 years
First developments promoted by foreign private firms	18.6 years	10-25 years

Source: Table VIII. 1a (simple average of the differences between the year developed at the international level and its local introduction)..

✱ - Except for continuos frame slabs.

189/ This comment clearly applies to the first 21 innovations in Table VIII. 1a. On the other hand, in the case of the remaining innovations (Table VIII. 1b) this follows from an analysis of the way they were introduced and the agent. In the last two columns it can be seen that they were all introduced into the local market by foreign firms, either by direct investment, or through technological licensing. When they were introduced by a local firm, in most cases it used foreign technical assistance or standards. This situation allows us to infer that these innovations were not developed locally since, if this had been the case, it would make no sense to contact foreign technical assistance.

As we understand it, the reasons for these differences are connected with five factors: a) the nature of development and adaptation of technology in the public institutions which monopolize demand in their own sector; b) the kind of innovation (if it was originally labour-saving or not); c) the industrial structure of the receiving country; d) the level and extent of the technical and financial resources invested in scientific and technical activities, both at the overall and sector level; and e) the size of the market.

a) Technological development and adaptation. Usually, the public institutions which are involved in infrastructure works operate in a monopsonic position which enables them to have a significant influence on the sector's technological profile through their purchasing or investment policies: for example, they can influence the kind of products or services they demand through their technical specifications - or they can also speed up or delay the introduction of new processes. For example, in the case of roadworks, when the state roads departments call tenders, they include specifications which may be connected with the results of their own research and which are usually studied by means of experimental stretches of road. This kind of activity is unlikely to be carried out by private firms, since both the high costs and the difficulties of obtaining direct rights over the results (through patents, in particular) make it unprofitable from the eyes point of view of the private entrepreneur. On the contrary, public institutions have to adopt a more progressive attitude: they must define the product they require, so that they are obliged to develop their own innovations or adopt improvements which have previously been developed abroad, in order to be able to gradually raise the level of their demands. For this reason, the widespread diffusion of new technological developments carries considerable weight in their improvement plans, so that their contractors may incorporate them and so improve the finished product.

The diffusion of innovations accepted by public institutions usually occurs through tender specifications which, because of their nature, make it necessary for new developments to be employed. This process, which is characterised by the free spread of knowledge 190/, enables different public institutions to absorb the new developments, because there is a constant flow of informa-

---

190/ The very nature of the tenders means that the new technological developments which are incorporated are spread freely, since they form part of the specifications which are available to all contractors.

tion 191/. This explains why technological lag is less in these cases and that its extent, in technology-importing countries, dependes on the time it takes for both the spread of results and the local decision to set up an experimental test to take place. It is quite clear from empirical observation (Table VIII. 2) that when a public intitution is the promotor, the lag is considerably less than when a private firm originates the invention. When the latter is the case, such firms tend to register their results through patents, so that they can prevent the introduction of new products by keeping their basic specifications secret.

In this respect, an initial explanation of the relative differences with regard to the extent of technological lag, is connected with how knowledge is created in the different productive units, and in particular whether it is of public or private origin.

b) Kind of innovation. In our opinion, a second explanation of technological lag lies in the initial objective of the research. If it was intended to substitute fixed capital for labor, since the relative price structure made such a substitution more profitable, technological lag will usually be greater in a technology importing country, particularly in those branches which have a quite different price structure from that of the originating country 192/.

191/ This analysis is valid not only for roadworks, but also for sanitation and electro-mechanical works, for example, An assessment of the practices of the Dirección de Vialidad can be found in Egberto Tagle, El Camino y la Técnica; Desarrollo de la Técnica en el Camino y El País, published by the Asociación Argentina de Carreteras, Buenos Aires, 1974, pp. 225-261. It is unusual to come across developments created by public institutions which have been patented. The same thing happens with regard to developments carried out by Universities. Nevertheless, there are cases in which the results of their research were patented and marketed by private firms. For example, the Forest Products Laboratory in the U. S. A. made several kinds of wood joints (for use in roof or beam construction), whose patents were acquired and marketed by the Timber Engineering Co. of Washington. This has mainly happened when the development was related to a product or component. On the other hand, when the development related to construction systems or to theoretical laws or principles, knowledge was freely divulged.

192/ In countries where the wage level is higher, automation in production processes is naturally more profitable, which is usually reflected in a high correlation between the wage level and the degree of spread of labor-substituting technologies. This is shown, among other studies, in A. Gebhardt and O. Hatzold, Numerical Controlled Machine Tools, in L. Nabseth and G. Ray (ed), The Diffusion of New Industrial Processes, Cambridge University Press, London, 1974, pp. 39-41.

For example, if we take as the technological frontier for the construction sector, the technologies employed in Europe or the United States, (which is fairly debatable), we shall see that the greatest lag (for similar works) is found in building construction. Most European or American analysts have emphasized that technological developments in those countries are basically due to the need to replace labour by capital, since there is a tendency towards a shift in relative prices, when the price of labor increases proportionately more than that of equipment 193/.

When this kind of technology was introduced into the local market - particularly into housing construction - it was unsuccessful, since it had to be adapted to specific conditions which were markedly different from those existing in the technology-creating country. Not only does the existence of cheap labor make the use of traditional systems more profitable, but capital intensive technologies, because of their high cost, requires constant use, which a local firm can only rarely achieve in the local market 194/.

Since the client buying a dwelling does not usually demand a particular type of building process; since the choice lies principally with the construction firm, the latter uses processes which allow it to maximize its profit rate by running the smallest risk possible in the market 195/.

Company fragmentation, which reflects a lack of ability to take advantage of scale economies arising from the use of capital intensive systems, proves the profitability of traditional systems which can be used perfectly well by relatively small firms (which operate almost exclusively as coordinators or the project). On the other hand, the introduction of capital intensive systems (which would mean a reduction of the technological gap, always considering as frontier technologies

---

193/ There are numerous references in which European or American researchers insist in this point. Among others we can mention: Ian M. Lezlie, Notas sobre la Industria Británica de la Construcción; Revista Construcciones N° 63, August 1950, Buenos Aires, p. 152; A. Santillana, Análisis Económico del Problema de la Vivienda, Ediciones Ariel, Barcelona, 1972; E. H. L. Simon, L'industrialisation de la construction, Paris, 1962, mimeo, pp. 42-46; P. A. Stone, Building Economy, Pergamon Press, England, 1966.

194/ In Chapter IX we refer to some local experiences which resulted in the introduction into the building market of capital intensive progress.

195/ Official tenders for housing construction also allow a fairly large margin for the choice of systems. There are cases in which the process which should be used is defined fairly precisely, but in practice these are the exception rather than the rule.

those employed in Europe or the United States) necessarily leads to a change in the supply structure, since capital intesive units are required, which must cease to be coordinators and become productive units. That is, the reduction of technological lag, in the case of building construction, would inevitably lead to a greater concentration of the business structure 196/.

This argument, valid for a market in which demand imposes no technical specifications on supply, loses some of its validity if applied to infrastructure works as a whole, since in these cases demand defines relatively precisely the kind of product it requires and the way it should be produced.

It is in this kind of market that labor -saving technologies can be introduced most rapidily (reducing its technological lag) if the climat imposes them in this conditions of tender or if, because of the normal unit work volumes, he allows scale economies which may lead to more concentrated business structures.

This is what happens, as mentioned in the previous section, in roadworks or dam building or the construction of sanitation systems of some complexity, where the client institutions operate, through their technical specifications, as spreaders of new techniques which may in practice involve substitution of labor. When there are more concentrated business structures, able to plan in the medium term 197/, the need for a high fixed capital endowment acts as an entry barrier to new firms, and the process of business concentration is thus stimulated.

In the public works market, for example, the competitiveness of the firms which adopt new technologies may also increase, since by incorporating equipment with a higher rate of productivity, their maximum contracting values rise, from which we can deduce that there is basically a direct correlation between business concentration, the level of competitiveness and the rate at which technologies are adopted.

196/ Closed prefabrication, for example, involves a large investment in new dyes each time a plan is drawn up, which requires, as with the setting up of fixed plant, a considerable amount of capital. In itself industrialization in housing leads to a break in the current supply structure. For a more detailed explanation, the following articles, among others, can be consulted: Prefabricación e Industrialización en la Construcción de edificios; varios autores, Editores Técnicos Asociados, Barcelona, 1968. Interview with F. Sainz Trápaga, Rev. Summa, op. cit. O. Altimir, La Vivienda en la Argentina, Aspectos Económicos Estudios sobre la Economía Argentina, CCE. N° 5. Agosto, 1969.

197/ We have dealt with this point more fully in Chapters IV and VI.

Various authors have commented that in some branches of industry this process is the reverse 198/. When a market is highly concentrated, the incorporation of new technologies depends basically on the strategy adopted by each firm. If it can manage to increase its profit margins by means of the spread of new systems technological lag will be less. Thus oligopolic positions do not necessarily lead to the introduction of new technologies. On the other hand, the building firms, even though they may control considerable sections of a submarket, are obliged to introduce new technologies, if they are to adapt naturally to the conditions imposed by demand, which may in this way modify their possible monopolistic beahviour.

c) Defects in the idustrial structure of the receiving country. The firms established in a technology-importing country do not always have a real capacity to introduce a new product or process. In many cases, it is first manufactured as the result of the installation of a new firm or a substantial modification to an already existing firm. There are cases in which the introduction of a new product involved the introduction of practically non-existent branches. This kind of industrial structure naturally limits the possibility of carrying out local development at the same time (or with short time lag) as the launching of the new product in foreign markets. Therefore, there is not only a high probability that the processes and technical specifications of the innovation will come from abroad, but also that the technological lag will be considerable 199/.

If we analyze the innovations included in part "b" of Table VIII.1, we can observe this phenomenon, since the vast majority involved, for their first commercial launching, direct new capital investment. That is, they themselves meant the introduction of new branches (chemicals, plastics, light or premoulded concrete blocks, among others) or a change in their relative weight in the manufacturing sector as a whole.

In this kind of industrial structure, the firms which have undertaken the first commercial launchings have a clear advantage over local capital to secure

---

198/ See, among others, Joe S. Bain, International Differences in Industrial Structure, Yale University Press, 1966, particularly Chapters 4 and 5; H. R. Edwards, Competition and Monopoly in the British Soap Industry; Clarendon Press, Oxford, 1962.

199/ The extent of lag in the electronic industry (semi-conductors, for example), reveals that the ability to assimilate new technologies as far as firms established in Europe or the U.S.A. is concerned, is one of the most decisive factors in the rate of innovation or difussion within each country. The original inventor's strategy enjoys much less freedom than we can see in technology-importing countries whose industrial structure is one of the principal factors determining their technological lag. For the semi-conductor industry, see John Tilton, International Diffusion of Technology (The Case of Semiconductors), The Brookings Institution, Washington, D.C., 1971.

the monopoly of the local market for the new product. Their direct capital investment (unless there is third party licensing) enables them to exploit a market which previously could only be covered by imports (given the dearth of local manufacturing), but which the corporation can begin to monopolize as soon as its operation is set up. Just as happened during the first stage of manufacture of a large number of major innovations (mainly referring to building materials) 200/ launched on the market through direct investment by firms backed by foreign capital (Table VIII.1b). In these cases technological lag depends on both the adaptive capacity of the country's industrial structure (with regard to its ability to incorporate new products) and the strategy employed by the international firms to spread its new technologies. If, for example, they have patented the processes or products they have developed, local manufacture will begin, depending partly on their own policies with regard to penetration of new markets. If they follow a policy of direct investment, technological lag (as when licensing is used) will depend on the aims of the corporation and its international competitiveness. In other words, when the industrial structure of a country operates as one of the most important factors influencing the introduction of new products or processes (involving major innovations) technological lag will be affected, to a large extent, by the policy of the original foreign inventors.

d) Technical resources. Another of the variables which affect a technology-importing country's technological lag related to the magnitude of its technical resources and the level of research required by each adaptation to local conditions.

Internationally, the first imitators are apparently these countries with a higher relative level of development, since due to their technical capacity and resources they can rapidly identify which are the significant foreign innovations 201/. The likehood of new technologies based on local efforts being introduced is related, in these cases, to the amount of research required. Thus, new developments in building systems which require considerable experimental resources to enable them to be applied, are unlikely to be undertaken in situations in which irregularity in the allocation of investment funds is the norm (as in the case of roadworks, for example). Something similar occurs with materials of road-building equipment, which require large resources to carry out practical experiments or even for their original developments.

e) Finally, a further variable which , in our opinion, affects the degree of technological lag is the size of the market. Generally speaking, the probability of a firm's introducing new technologies (or products) increases with the number of po-

---

200/ We shall deal more fully with this point in another work, also presented within the BID/Cepal programme.

201/ J.E. Tilton, op. cit., pp. 3-6. See also E. Mansfield, Technical Change and the Rate of Imitation in Nathan Rosemberg (ed). The Economics of Technological Change - Penguin Books, England, 1971, p. 310.

tential users (or the structure and level of personal income) 202/.

In the case of the construction industry, the influence of market size varies of course, if we consider processes and products separately. Its effect on each kind of project also varies. In building construction, for example, varaibles such as the structure of personal income have greater influence and naturally affect the kind of products (or inputs) used in building, On the other hand, in the case of building processes related to housing, the extent of technological lag depends not on the overall market volume, but on the existence of large individual projects which show a certain continuity over introduction of labour-saving processes. We can see, then that in the case of building construction, the size of the market affects lag in different ways: where products are concerned, it depends mainly on volume, whereas for processes it depends particularly on the unitary size of each individual request.

Another kind of factor influencing the size of the market for new building materials arises a priori from the technical requirements imposed, in the case of public works, by the client institutions. Before a new product can be employed for example, it must have been previously tested in the materials testing laboratories which are directly linked to the client institutions 203/. They can only be included in the tender specifications if they have been technically approved by the quality control laboratories. Market size and the time of introduction of the product do not here depend, solely and absolutely, on the supplier, but rather the latter is directly affected by the institutions which decide the kind of input to be employed.

A significant number of innovations were introduced into the local market through experimental tests carried out at the request of the client in technical laboratories belonging to public institutions (Table VIII. 1). This requirement, which has influenced the time when the product was introduced (and therefore the technological lag) also determines the potential market size, according to whether or not it is accepted for use in the different public works.

202/ Tilton, op. cit. pp. 4-6.

203/ There are laboratories in public institutions which are not directly connected with construction, such as the Inti laboratory, for example. But the main work is concentrated in the laboratories of the client institutions (Lemit MOP in the Province of Buenos Aires, Obras Sanitarias de la Nación, etc.). This is the case mainly for public works. On the other hand, in housing construction, where this requirement refers only to projects financed by the Secretaría de Estado de Vivienda, control is exercised through Technical Approval Certificates which attempt to endorse the suitability of a product or system. For the remaining building works there is a greater degree of freedom, since the client does not explicity impose technical specifications requiring prior materials control.

This is a basic characteristic of a situation in which the client promotes the introduction of new innovations. At the overall level, several authors have commented that the developments resulting from the demand structure, at a specific income (or expenditure) level, take less time to be carried out or spread in relatively more developed countries 204/. This is true when there is no direct determining factor as in the construction industry. In this kind of situation, the introduction or lack of it (that is, lag) depends on an explicit decision by the client, who usually operates in a monopsonic position 205/. That is, when the client exercises a direct influence of the innovative process, the time taken to introduce a new product or process is more likely to be reduced or its diffusion

---

204/ Among others, See Tilton, op. cit., and the articles included in the book by L. Nabseth and G. F. Ray, op. cit.

205/ There are authors who argue that in some cases the action of public institutions produces the opposite effect and delays the introduction of major innovations. For example, Dr. Julio Pizzetti considered in 1955 that local backwardness in carrying out projects using prestressed concrete was due to two characteristics inherent in public institutions: on the other hand, he explained that because of a "mental attitude" (...) "public institutions did not grant foreign exchange licenses for the importation of the necessary equipment or materials", and secondly, because of the "slight interest shown by state institutions in introducing new processes". Julio Pizzatti, Hormigón Pretrensado. Los Problemas de Realización. Las Posibilidades en la Argentina. Construcciones N° 124, September 1955, Buenos Aires, pp. 135 and 136. It is undoubtedly true that the lag in the introduction locally of prestressed concrete was considerable (Table VIII. 1a). However this can be ascribed not only to a subjective reason, but to the nature of the innovation which, as it involves a substantial change in construction methods, requires for its use exhaustive knowledge of the procedure, which could only be achieved through local experimentation. Until this occurred - that is, until the public institution was almost completely sure of the method's effectiveness - it was fairly unlikely to accept its introduction into local projects. It is perhaps more impoertant to consider technical certainty as a variable explaining lag than the subjective element here referred as "a mental attitude". Nevertheless, it is true that there is a problem of bureaucratic inflexibility inherent in all structures of the size of many public institutions.

more likely to be widespread) 206/.

III - Rate of Introduction of Major Innovations.

Any classification which attempts to establish a fairly precise periodization with respect to the inflow of technology which has taken place in a sector is, of course, a certain extent arbitrary, and this may occur when we attempt to describe the development of the inflow of technology in a particular branch. It is not always possible to fix precisely the start of certain activities and work out a pattern to show the actual development of technological change over time, which naturally differs according to the branch in question. For example, the birth of the automobile or electronic industry can be fairly precisely establised but it is almost impossible to do so for the construction industry since it is an activity inherent in man. Many of the basic principles or inputs used today were developed several milleania ago 207/. It is also true that, unlike the che-

---

206/ There are other potential reasons which may explain the degree of technological lag in a technology-importing country. The following are possibilities: a) a country's natural resources endowment; b) the sophistication of the product introduced (although this is included in the technical complexity or the research and development expenditure endowment analyzed previously); c) the age of the capital stock; or d) the possibilities of importing the product. We believe that in the case of the construction industry, the first aspect, that is, the natural resources endowment, may be a significant variable. But to prove this would have involved an exhaustive study of the information, which was beyond the scope of our research. Nevertheless, we believe it to be an important aspect. The physical characteristics of a country have also been offered as a possible explanation. Resnick Brenner has rightly observed that "the assembly of structures from factory-produced materials offers the negative aspect of long distances between factories and sites, a characteristic typical of our large country. Indeed, some European heavy manufacturing systems have been imported which, although successful in their countries of origin, when trasferred to this country, were a failure, because the item "transport" had not been studied in detail". Interview with M. Resnick Brenner in Industrialización de la Vivienda: Proyecciones. Revista Summa N° 69, November, 1973, Buenos Aires, p. 80.

207/ Various authors have shown, for example, that ancient peoples, among them the Persians and the Egyptians, used natural asphalt to cement and water proof their buildings, 2,000 years B.C.. The same can be said for almost all light concrete blocks, which form the basis for the inputs used in modern buildings. Without going back into antiquity, we can see that the first asphalt roofs were used by Fax in Sweden and Kak in Germany in the 18th century, although they were first used on a large scale at the beginning of this century. H. Abraham; Asphalt and Allied Substance, 1945, 5th edition.

mical or pharmaceutical industries, no new products arise from construction activity (as a service), buth the process of change can be observed through alterations in construction systems or in the introduction of new inputs.

This criterion, which will be the basis of our analysis, will enable us, despite its possible defects, to describe the stages which characterise the flow of technology, by elucidating the elements which define different periods according to the kind of innovation introduced. We shall in this section mainly describe the historical development of technological change by identifying the moment when the major innovations were developed internationally.

From Table VIII. 3, where we can see the year in which the major innovations here studied were developed (and the moment when they were introduced into the local market), we can reconstruct four relatively differentiated stages:

- 1820/1870. - Development of basic products:
- 1915/1937. - Development of light machinery and widespread experimentation with basic systems.
- 1945/1958. - Development of large heavy machinery, introduction of chemicals and plastics and widespread use of prestressed concrete and
- 1960/ - Introduction of electronic systems for calculations and design (computation).

The first period, which we characterize by the introduction of the two principal materials, Portland cement and reinforced concrete, can be defined as the stage of basic developments, after which there is a prolonged period of learning and knowledge accumulation which substantially improve the original development. This means a significant technological "leap forward" if we compare the technical specifications laid down initially with the ones now known 208/.

208/ The Instituto del Cemento Portland Argentino explains that some of the important technological advances are due "to the knowledge achieved by means of technological research and the development of analytical calculating methods, combined with a considerable number of experiments and tests and the results of studies on the behaviour of service structures". He explains, in synthesis, that "progress in the manufacture of concrete products has been due to the combination of three elements: progress in the technology relating to concrete and its components; the parallel development in the plans and calculations of its materials and innovations in the equipment, mechanism and methods used in industrial production". (Cemento Portland N° 46, p. 16 and Cemento Portland N° 59,

Table VIII. 3 Rate of Technological Progess

First manufactured locally	Year Discovered Internationally
	1824 Portland Cement - England - Joseph Aspdin
	1867 Reinforced concrete - France - J. Monier
1900 Reinforced concrete - first Argentine patents	
1916 Portland Cement - Lone Star Co. U. S. A.	1916 First Cement-manufacturing plants - U. S. A.
	1919 Light bulldozer - U. S. A.
	1920 Air incorporated into cement - USA
	1921 Continuous frame slab - U. S. A. Emulsified ahphalt - France
	1923 Fine cold asphalt - Germany - England Cement roadways - USA (First basic formulae) High resistance steel - Austria
	1925 Shell domes structures - Germany
1928 Cement roadways -M. O. P	1928 Prestressed concrete - France - E. Freyssinet
	1930 Porter Method (CBR) - Flexible paving - U. S. A.
	1931 Heavy bulldozer - U. S. A. - caterpillar
1935 Emulsified asphalt	1935 Cement surface - U. S. A. - (state institutions) Front mechanical spade - U. S. A.
1937 Cement surface - ICPA D. N. V.	1937 Chalk surface - U. R. S. S. - U. S. A.

1939

1940 Foam glass - U. S. A. - Pittsburgh Plate

1941 Reinforced glass- blindex-England armour plate

1942 Cement-manufacturing plants L. I. P. S. A.

1942 Expanded polystyrene-Germany-U. S A.

Sawing of joints - U. S. A.
Development of roadworks equipment

1945 Application of California method (CBR) -D. N. V.

Prestressed concrete-Acerbeton S. A. and I. C. P. A.

1945 U. S. A. (mainly)
Modification to road systems
Epoxi-Switzerland-U. S. A.

1949 Air incorporated into cement Lemit
Tiles-Cerámica San Lorenzo

1950 Tubular structures-Acrow

1950 WASHO Road Test - U. S. A.

1951 Chalk surface

1951

Solid paving- new standards introduced

1952 Mechanical spade on wheels - U. S. A.

1953 Fine cold asphalt

1954 Slopform paver - U. S. A.

1955 Sawing of joints-I. C. P. A.

1955

1958 Neoprene joints - U. S. A. - first used
AASHO Road Test - U. S. A.

1960 Heavy bulldozers-CONARG S. A. - D. N. V.

1960 Technique for designing concrete paving - AASHO Road Test - U. S. A.

1962

1964 Continuos frame slab - D. P. V.
I. C. P. A.

1968 Neoprene joints - Pirelli-
Du Pont
Chalk surface-sand asphalt
Celestino Ruiz and others
(Arg)

1969 Large scale manufacture
of heavy equipment

This phase is linked basically with individual inventors (Aspdin, Lambot and Monier, among others), who do not always make their discoveries while trying to achieve a new product of process for the construction industry. J. Monier, for example, who was a French gardener, first developed reinforced concrete when looking for new materials to make flowerpot stands. Lambot did so while building a concrete boat.

The second stage (1915-1937) occurs against a rather different background. At the international level, the big road investment programmes are beginning (which in this country are related to the promulgation of the Organic Roadworks Law, ratified in 1932) which stimulated both research on basic construction systems and the development of new earth-moving equipment. This stage is characterised by the setting up of research departments in state institutions, which begin to study experimental road sections (and which will be reflected in a freely published body of knowledge) 209/ and by the merger of the large American earth-moving equipment manufacturers. For example, in 1909 Holt and Caterpillar merged and in 1925 took over the firm of Best, thus creating the Caterpillar Tractor Co.. The latter, in 1928, acquired Russell Co., which had developed the first light bulldozer based on an agricultural tractor 210/. In this respect, parallel to

---

p. 1). This has meant, according to G. Donald Kennedy that "recently build concrete paving is as different that of 25 years ago as today's high-powered cars are with respect to those of half a century ago." Today, he says, "concrete paving, properly designed and built, can have a useful working life two or two and a half times as long as the concrete paving built thirty years ago"; G. Donald Kennedy, Construcción de Pavimentos de Hormigón en Estados Unidos, Revista de Cemento Portland N° 53, September 1961, p. 6. The same thing happens with prestressed concrete, since, because of greater theoretical and experimental knowledge and more resistant materials, it has been possible to progress in a short time from bridges of 50 to 60 metres span to bridges of 300 to 350 metr metres span between pillars.

209/ Basic principles were also developed, which substantially improved construction techniques. For example, between 1918 and 1925, Duff A. Abrams in the United States carried out a number of experimental investigations which provided ample information about the mechanical and physical properties of concrete. Similar contributions in other fields were due to Kerkhoven and Dorm, Westergaard and Older, for example.

210/ Simultaneously, a process of technical complementation takes place between the large international manufacturers. For example, R.G. Le Tourneau invents the first version of today's motortrailer, providing an interchangeable traction unit which is incorporated into what is today the Allis Chelmers modular system. J.A. Brochiero, Técnica Constructiva - Equipos para Movimientos de Tierra, in Aportes para la Obra Vial N° 3, Cámara Argentina de la Construcción, Buenos Aires, 1965, pp. 78 and 79.

the great stimulus to roadworks investment and the appearance of new basic systems, there is also a process of concentration and monopolization in the euipment industry, through the merger of firms with a more rapid technological development, on which they partly base their market control.

The third stage (1945-1957) is, in our opinion, influenced by two different phenomena: on the one hand the European reconstruction process and the mass undertaking of roadworks in the United States begin, which stimulate the development of large heavy earth-moving equipment and culminate in the mass adoption of the pneumatic tire, which replaces both the decauvelle tracks and the old caterpillar traction systems 211/.

This, which practically revolutioned construction methods, occured at the same time as the search for new technical specifications to ensure maximum efficiency in roadworks investment. In this way, both the WASHO and the AASHO Road Tests were successfully developed, backed by the American Association of State Highways Employees. They marked a huge step forward in knowledge concerning methods of making rigid and flexible paving 212/.

211/ The postwar roadworks plan in the United States brought about the great development in the equipment industry. In 1943, for example, the Vice-President of the American Association of Highway Builders said that " the deficit accumulated during the war in local and foreign highway construction will keep construction machinery manufacturers working at full capacity during the immediate postwar years". "Therefore, since the United States has a virtual monopoly over construction machinery manufacture", it will also be able to head the Technological progress developing in the sector. That is, associated with a highly profitable activity, and monopoly in the sector, new technical developments enable the market structure to be reproduced. In this connection, see Revista Construcciones N° 5, October 1945, Buenos Aires, p. 61.

212/ Egberto Tagle explains, for example, that the Eisenhower plan, which involved the investment of 80.000 million dollars in interstate highway construction, made the legislators demand that state moneys be invested with maximum efficiency by means of extensive roadworks experiments to test the correctness of the paving design methods and the structural calculations of drains and limited span bridges. "Thus was created", he says, "the most remarkable roadworks experience of the century, known by the name of A. A. S. H. O. Road Test". which made possible a significant advance in the roadworks field. The WASHO Road Test was similar; the initials stand for the Western Association of State Highways Operatives, who built a number of large scale experimental road sections, markedly improving knowledge about flexible paving. Egberto Tagle, El Camino y la Técnica, Desarrollo de la Técnica en el Camino y el País, Asociación Argentina de Carreteras, Bs. As., 1974, pp. 240 and 241.

At the same time, a second phenomenon occured during this stage: the widespread use began of a number of chemicals and plastics which markedly improved heat and acoustic insulation, the hardening and compacting of concrete and the degree of roughness of paving, among other things. This was not only because of the development of new products specifically for the construction industry, but also because of the overall progress in the chemical and plastics industries, which enabled new combinations of inputs to be used or the new construction systems to be created 213/.

The foregoing proves that the process of technological change has been promoted, to a considerable extent, during this stage, more by progress outside the construction industry than by the introduction of innovations developed in the branch itself. This process has been strengthened during the last decade by the introduction of computers for design and for structural calculations (fourth stage, beginning approximately in 1960). Technological progress which, between 1915 and 1937, concentrated on the development of new theories and systems, allowing the free dissemination of knowledge, after the Second World War concentrates on equipment and products introduced into the world market as proprietary as knowledge.

At the local level, this process is reflected, as we saw in the previous chapter, in a change in both the origin of patents (an increasing number coming from foreign sources) and in a qualitative change in the item patented, since there is a drop in the number of systems patents, and a proportionate rise in the number of equipment and products patents. That is, the technological flow tends to develop in branches supplying materials and equipment, whereas it declines in the construction industry (understood as an assembly industry). That is, by an analysis of the rate of introduction of major innovations a similar process can be observed to that which

---

213/ The present trend is generally to repalce simple materials such as natural blocks, lime, plaster, bricks, iron, wood, etc. with products which have undergone varying degrees of processing, among which we could point out lightweight artificial blocks, such as expanded clay, asbestos, cement, panels of sheets of various materials or the "sandwich" kind, plastic films, insulation and adhesives, additives, sealers, plywood, polyvinyl chloride profiles (PVC) and aluminium, among others", (Several authors, La Industrialización de la Construcción; Propuesta y Posibilidades de Desarrollo. Paper presented at the Primer Simposio Latinoamericano sobre Racionalización de la Construcción. Miemo, Buenos Aires, 1973). Other authors show that cement derivatives occupy the leading position among the new materials. Discounting the most common prefabricated materials made of ordinary concrete and steel, such as small beams and domes, mass production of prefabricated materials made of cellular concrete has increased makedly; they are very resistant, light and give excellent heat and acoustic insulation. (Información Comercial Española, op. cit. p. 110).

emerges from an analysis of the aggregate flow of patents. On the other hand, this trend towards the introduction of a more complex kind of equipment involving a higher level of fixed capital per product unit, inevitably leads to an increase in the average size of firms (which, depending on the developmentsof demand may lead to an increase in the degree of concentration). This occurs mainly with infrastructure projects, where there are technological indivisibilities. On the other hand, its effect is less marked in markets where technological progress is slower (building construction, for example) 214/.

Something similar occur in sectors in which the innovative capacity of the established firms is a variable relevant to an explanation of businesss concentration. For example, a slowdown in technological progress in the larger firms causes an increase in participation by medium-sized firms, which then begin to catch up with the larger ones 215/.

On the other hand, in the construction sector, although the introduction of innovations originating in the supply sectors has compensated for the decline in technological progress generated in the sector itself, the results do not necessarily affect all firms equally; it is their relative size, prior to the introduction of the innovation which will establish their growth possibilities. If the new technology is labour-saving, and increases the firms' fixed capital, it will tend to bring about a process of concentration, in which the larger firms will benefit most, since their ability to undertake long-range, large volume works

---

214/ There is a general consensus that the rate of technological innovation in the building construction industry is relatively low, despite the constant registration of new systems. For example, in the United States 1,055 non-traditional systems have been registered (U.S. Department of Housing and Urban Development, 1970), a number of similar to that registered in several European countries or rather higher than Argentina where 355 non-traditional systems were registered. But the technological change which arises from each individual system is not of great significance. This gives rise to a strange paradox: although new construction systems are always appearing (showing a constant flow of new innovations), no-one has any doubt that building construction is still one of the most markedly backward branches of industry. It is, therefore, no by chance, that many authors consider the remarks made by W. Grepius in 1928 to be clearly applicable to the present situation: "in the United States, I found a very expressive graph which compared the price curves for buildings and cars; in the same period during which the prices of construction projects doubled, the price of cars dropped surprisingly. If we transfer this graph to the present situation, we see that the price of cars has continued to drop steadily, whereas housing costs have risen. This clearly demonstrates that our present building methods are lagging behind". Taken from Luis Lanari, interview, in Revista Summa N° 69, op. cit., p. 79.

215/ See Jorge Katz, Oligopolio, Firmas Nacionales y Empresas Muntinacionales. La Industria Farmacéutica Argentina. Siglo XXI, Argentina, Buenos Aires, 1974.

enables them to introduce the new processes and improve their position on the contractors' register. In other words, if the flow of technology tends to modify the type of equipment or make the company structure more complex 216, there will be a trend towards a greater concentration than if the innovations come from the sector itself (these are usually freely divulged in the market). This occurs because here the results of technological change tend to affect all firms equally (regardless of their size), since the innovations are usually advances in knowledge of basic principles. That is, they can be equally well internalized by all firms.

IV. Agents of Technological Change.

If we identify the agents of technological change 217/ from our list of major innovations (Table VIII. 1a), we observe that the areas in which public institutions and private agents carry out their research are clearly differentiated (Table VIII. 4).

Table VIII. 4 Origin of Major Innovations
(agent responsible for local introduction)

	Developed in the public sector	Developed in the private sector
Construction systems	87.5%	12.5%
Equipment & components	7.7%	92.3%
Total	38.1%	61.9%

Source : Table VIII. 1a.

216/ This is what happens in the submarkets, where the furm's intrinsic technical capacity, expressed via its accumulate experience and the number of its staff and their skill, is a determining factor for obtaining work contracts.

217/ In out study, we understand as agents of technical change the institutions or people who promote technological developments in the sector, either original ones or via adaptations of processes created overseas.

We could not logically have reached any other conclusion, since, as the sample is limited to the major innovations (and building construction systems have been excluded for the reasons previously stated), the effect of the public sector as a promotor of new construction systems increases considerably 218/. In any case, the table shows a relatively clear trend: the core of technological activity in the public sector is the development or adaptation of construction systems, whereas in the case of innovations in the area of materials of components, activity is mainly centred on the standardization and control of new products 219/. They carry out the latter kind of research at the request of the manufacturers themselves, who in order to gain access to the public works market, must have a technical approval certificate for their products 220/.

This mechanism favours the spread of products and allows standards or certificates to be used as a distinguishing factor in those markets where no prior quality control is required. Usually this arises from a situation in which the contractor proposes or promotes new innovations, but their spread (or use) depends on an explicit decision on the part of the client (or of a group with real decision-making power, because of their relative power in the market). In this case, the actions of both client and producer combine to make the new product or process known. This is different from diffusion and promotion supported exclusively by

---

218/ If building construction is included, it is likely that the public sector will have less weight, but this would involve modifying our criterion of major innovations. In any case, it is worth mentioning here that most building construction systems were developed by construction firms or indpendent private inventors. See, in this connection, Certificados de Aptitud Técnica, published by the Dirección de Tecnología de la Secretaría de Estado de Vivienda, Bs. As. 1975.

219/ This is carried out in the official experimental and materials testing laboratories, particular those we described in Notes 187 and 201 of this Chapter.

220/ In general, the tests carried out by state institutions are made at the request of the manufacturers themselves. There are cases in which their activity is more than a simple technical check, when they carry out adaptive research which may lead to a choice made in the laboratory, without the manufacturer having made a prior proposal. The Administración General de Vialidad is an example; in 1948 it acquired a share in a commercial product made from asphalt and rubber, manufactured in the United States under the norms of Federal Specification SS-F-336, with the aim of testing it on different sections of road to determine its behavior andlenght of life under the climatic and traffic conditions in this country. It was also compared with other products used up to that time, among them, mixtures containing plaster and talc. This kind of research, which have taken as an example, can be found in many of the jobs undertaken by the testing laboratories of public institutions. For example, see technical bulletins of Inti and Lemit and Revista Construcciones, N° 37, June 1948, among others.

supply through research institutions which are financed by the materials manufacturers, but which operate independently of the individual firms. For example, cement producers have established the Instituto del Cemento Portland Argetino (I. C. P. A.) which carries out research with the aim of increasing local use of the product, either by publicing new ways of using it (whether discovered abroad or not) or by adapting them to new combinations 221/. The structure of the industry itself (and possible implicit agreements concerning market division and price fixing) favours the development of research institutions which constantly seek to expand the market, but which do not, because of the kinds of objective they pursue, change the domestic ologopolic relationships.

Another form of promotion and diffusion supported by manufacturers corresponds to some extent to the specific characteristics of the productive process of the construction industry. Generally, manufacturers tend to spread and promote the use of systems which use their own product as the basic input, even if legal ownership of the system belongs to a third party. This is what happens, for example, with prestressed concrete, which is promoted to a greater extent by the cement manufacturers of steel producers than by the actual patent holders. The cost of diffusion hare falls not on the person who "manufactures" or markets the product, but on the input suppliers.

In this respect, both the last two kinds of diffusion or research, and those carried out by the materials testing laboratories at the manufacturers' request, basically tend to expand the market as an explicit aim 222/, which is, of course

---

221/ Among "the aims which rule the activities of the ICPA is advice to professional engineers, construction firms, public institutions, manufacturers of products connected with construction and any other user of Portland cement, on problems concerning the use of this product", Boletín N° 6 of the Instituto del Cemento Portland Argentino. In fact the I. C. P. A. has a structure similar to that of the Portland Cement Association of the United States, dedicating part of its research not only to systems or new combinations, but also to testing materials. For example, instruments for use in research into concrete pavements, concrete flooring, articulated blocks and prestresse concrete, were adapted from specifications of Portland cement in the Laboratorio Tecnológico del Campo Experimental del I. C. P. A. These kinds of institutions usually plays a permanent complementary role to each other since in both countries they depend on the cement manufacturers. Boletín del I. C. P. A. N° 12, January-February, 1969.

222/ From the point of view of the public institutions, the experimental and materials testing laboratories have as their main objective to guarantee that technically proven inputs are used in public works. From the point of view of the client, research tends to be a kind of technical underwriting for the choice of his inputs.

logical in a situation in which supply promotes the spread and use of new innovations 223/.

On the other hand, when it is demand which promotes the introduction of new innovations, the basic objective is no longer related to a problem of market size, but to an attempt to technically optimize the use of resources. This is seen mainly in public works, where the concentration and unit volume of demand allows the formation of research groups in the client institutions, which usually undertake two kinds of activities. On the one hand, they draw up plans for each project; that is, they define the product they require, and on the other, they undertake adaptive research into new systems and components 224/.

223/ There are other kinds of diffusion promoted by supply, but in our opinion they do not have the same importance as the previous ones. For example, technical journals are used to explain, at the theoretical level, the properties of a particular product. As examples, the following can be quoted: Kjellman Franki; la Estabilización de Terrenos Finos Mediante Drenaje de Profundidad, Suecia 1936; Francisco Indaco de S. A. Dalmine of Italy, El Tubo de Acero en la Construcción de Armaduras-Construcciones N° 28, October 1947, Buenos Aires. Manual de Construcción de Estabilizados con Cal; Translation of Canteras Malgueño S. A., M. Biffignardi de S. A. Dalmine of Italy, Aplicación de Cabriadas Tubulares en Italia, Construcciones N° 45, February 1949, Buenos Aires.

224/ Some of the adaptive research undertaken in public institutions has led to original innovations. Referring to the Dirección Nacional de Vialidad, Egberto Tagle says that "we were able to perfect the technique for our surface bitumen treatment" (...) "by adapting the construction techniques to the nature of the gravel in the area, and reached a degree of perfection that was praised unreservedly by outstanding foreign technicians who came to the country during technical conferences, especially the Permanent Asphalt Commission. Besides the methodology contained in the technical specifications of Vialidad Nacional for this kind of bituminous coating, the following deserve mention as an Argentine contribution to roadwork technology; the cubicity test, published for the first time in October 1939; the 9:5:3 Rule, published in the same month of 1941, and the uniform bitumen spraying test adopted by Vialidad Nacional also in 1941. The cubicity test enables the shape characteristics of the stone blocks to be determined; the rule mentioned is a method of diluting asphalt material in simple, double, and triple bitumen surface treatments, worked out according to our own technology, which then has made it possible for Argentine experience in this kind of bitumen coatings to be synthesized in three simple ratios, which from then on would allow any road technician to dilute a treatment, even though he had no training in the subject. Finally, in the uniform bitumen spraying test a way was stipulated of checking the regularity with which the bitumen distributors applied the asphalt adhesives without the terrible grooved sprays, the re-

Generally speaking, the kind of research undertaken by public institutions tended to be adaptive, based principally on research carried out by foreign institutions. The clearest example in this respect can be found in roadworks. Standards and systems developed in the United States were usually adapted (Valor Soporte California, C. B. R. or the results of the AASHO and WASHO tests among many others), but without any large scale research having been carried out. This defect is commonly ascribed to a problem of market size. On this point, Egberto Tagle states, that it would be "difficult, if not possible nor justifiable, to divert roadworks funds for experimentation (...) even on a very limited scale" 225/.

This kind of profile, not exclusive to road construction, has meant, along with other reasons, that a significant part of local research and development has been of a subordinate and adaptive nature, since it has been primarily aimed at obtaining marginal improvements and/or adaptations to the local enviroment of products or productive processes previously employed abroad 226/. This kind of adaptive research should indeed be carried out, but the defect lies in the fact that this is the core of local research and development. Finally, if we consider both the flow of patents and the kind of major innovations, we note that the construction firms have not played an active role as potential agents of technological change, but have had to adjust tothe technological advances originating with the clients themselves or with the materials or equipment suppliers.

In general terms no technological developments arising from their research have been observed, since the majority have worked from plans drwan up by third parties: their activity definitely centred more on the "assembly" of the project than on the technical specification of the product (an area where there is potential original research). It is perhaps in building construction where some of the innovations (mainly in systems) have been created by construction firms 227/ although many of them have only involved minor innovations.

---

sults of which crept into the treatments several months after they had been carried out and which it was impossible to correct without preparing a new treatment. This kind of refinement relating to the efficiency of the asphalt distributors appear in the foreign technical literature in 1960 and 1964". Egberto Tagle, op. cit., pp. 233-236.

225/ Op. cit., p. 248.

226/ Jorge Katz, op. cit., p. 13.

227/ Of the total number of Technical Approval Certificates, 85% of those related to systems were granted to construction firms.

So far, we have analyzed as variables explaining the flow of innovations, both technological lag and agents which have promoted technological change, and also although only marginally, the origin of each innovation and type and magnitude of technological contracting from abroad.

In the following chapter we shall analyze these points, taking as our basis the introduction of technology carried out by construction firms on the basis of foreign contracts. To some extent this will enable us to define the areas in which there is apparently no local technological capacity and where this gap is filled by construction firms introducing foreign technology. That is, we shall attempt to assess what its introduction means in order to identify the areas in which there are real deficiencies.

Chapter IX. Contracting of Foreign Technology.

In recent years it has been accepted in Latin America that technology should be analyzed on the premise of its inherent nature as a piece of merchandise. It is already a commonplace to speak of its introduction as "technological trade" rather than transfer, given that dependent knowledge is always introduced through the mechanisms of a clearly imperfect market where the different negotiating powers of the parties plays a central role in determining the price. A large number of studies, also carried out during the last few years, which analyze the characteristics of the technological market at the overall level, have provided a basis for the development of industrial studies which show extremely clearly the way in which the technological market functions 228/. Despite this vast number of sector studies, it is difficult to find one which refers specifically to the construction sector. It is likely that its special characteristics result in contracting modes different from those of the industrial area, although they cannot, of course, be so very different in their general features.

A construction firm can, for example, contract foreign technical assistance in order to carry out all its projects - a process similar, perhaps, to that which exists in the manufacturing sector - or it can take out a license for one specific project; that is, for one of its products which is unlikely to be repeated over time.

We could consider, a priori, that the limited possibility of carrying out mass-produced constructions makes it unlikely that the kind of technical assistance which a construction firm may require will be related to all its works, since each one is usually different with regard to its volume and technical complexity. It would be logical to expect that, if foreign technical assistance is contracted, it should be related to specific works or to modular systems or processes, which make up only part of a firm's turnover, but almost never the whole of its activity.

That is the question we shall attempt to answer in this chapter. In order to do so, we have divided it into two parts: in the first one, we shall analyze the contracting of permanent technical assistance through patent, know how or process licensing from foreign firms (that is, contracting which involves the payment of royalties for all or part of a firm's turnover, but which is related to all its works), whereas in the second part we shall analyze the contracting of foreign technology for the construction of a specific work. We shall thus differentiate the

---

228/ As an example, we can mention the studies by Constantino Vaitsos, The Process of Commercialization of Technology in the Andean Pact (mimeographed), Lima, 1971; Jorge Sábato, El Comercio de Tecnología, CACTAL 27, 1972, and Máximo Halty Carrera, Producción, Transferencia y Adaptación de Tecnología Industrial, OEA, 1971.

contracting of "permanent" technology 229/ from that which is contracted sporadically for a specific work of plan.

1). Contracting of Permanent Technical Assistance.

In Table IX. 1 we have classified the construction firms which towards the end of 1975 held valid contracts for technology with foreign firms, while in IX. 2 we classify some of the firms which in the past contracted foreign technology, but whose contracts have expired, either because the firms have disappeared from the market or because the agreements have expired.

The list of methods and processes licensed abroad, compared with the total number of contracts in force in this country around 1975, shows that the proportion has not been very significant for the sector. It is not hard to conclude that of a total of 1484 contrats, 21 is an insignificant number 230/. Nevertheless, if we examine the agreements described in Table IX. 1 we can infer new forms of company behavior which show fairly clearly how contracting of foreign technology was carried out when all a firm's sales were committed.

In practice, we shall analyze four aspects, in order to describe: a) the kind of firm which has undertaken the contracting (preferably describing the origin of its capital); b) the aim and characteristics of the egreements; c) the area or kind of works they related to, and finally d) we shall attempt to describe the reasons for licensing.

a) Kinds of Contracting Firms.

From the list of contracts it appears that no construction firm backed by

---

229/ In contrast to the contracting of technical assitance by kind of work, we could also call it "indefinite contracting" of "periodic" although we have preferred to call it "permanent" because it implies systematic and permanent royalty payments over a period of time.

230/ Although perhaps we may think the opposite, since in 1972 a number of contracts similar to that of sectors like tobacco (22), petrochemical products (24) and household electrical appliances and accessories had been registered (20). But we should also bear in mind that in this stage we are only considering permanent agreements, since if we take into account all the contracts (including those agreements for a specific work, which makes a total of 44), their importance may resemble that of sectors such as petrol refining (34) or textiles (42). For the distribution of contracts by sector activity, we have taken the information from "Inti, Aspectos Económicos de la Importación de Tecnología en la Argentina in 1972", Buenos Aires, 1974.

Table IX. 1 Technology Ageements

Local firm	Granter of license	Country of Origin of Granter of license	Object Transferred	Characteristics	Amount of Sales Committed	Year of contract
Austin Sudamerican S. A. (USA)	The Austin Co.	USA	Technical advise for industrial plant construction	Technical & Commercial Assistance	100%	1966
Acueductos S. A. (Spain-France)	Materiales y Tubos Bonna S. A.	Spain	Prestressed concrete pipes	Plans for manufacture	100%	1971
Pilotes Franki Arg. S. A. (Belguim)	Compagnie Internationale des Pieux Armés Frankignoul S. A.	Belgium	Piles	Trademarks, patents, technical asst', installation	100%	1935
Jaime Bernardo Coll S. A. (Argentina)	Materiales y Tubos Bonna S. A.	Spain	Prestressed concrete pipes	Technical advice	Partial	1969
Rodio Arg. S. A. Switzerland	Solexports S. A. (Rodio Int.)	Switzerland	Concrete perforation and injection	Patents, trademarks, technical assistance	100%	1955
Sociedad de Cementos Armados Centrifugados SCAC S. A. (Arg. -Italy)	Nomko, Gesells Chaft Fur Nomko Truktionen und Stat ik	Germany	Prestressed concrete shells	Patents		1970

SADE S. A. (Italy-USA)	Sadelmi	USA	Adm. services accounting advice, marketing	Financial, commercial advice	()	1971
SADE S. A. (Italy-USA)	Export. Div. Gen. Electric Co.	USA	Adm. services, accounting & commercial advice	Technical Asst'.	(a)	1969
Criba S. A.	Treport S. A.	France	Bridge-building system	Patents	Partial	1971
Criba S. A.	Horizontal Drill S. A.	Spain	Horizontal Tube perforations	Patents	Partial	1971
Cía. Sudam. de Silos S. A.	Etabl. Tech, d'Expansion Ind. et Comm.	Liechtenstein	Silo construction	Patents	Partial	1963
Constr. La Plata S. A.	Binishells SpA	Italy	Reinforced concrete dome	Patents, know how	Partial	1969
Conevial S. A. Sebastián Moronese S. A.	Rocla	Australia 1/	Concrete pipes constr. syst,	Patents	Partial	1953 (2)
EACA-Pretensac S. A.	B. B. R. V.	Switzerland	Prestressed concrete system	Patents	Partial	1959
STUP	Soc. Technique pour l'utilisation dela Precontrante STUP	France	Prestressed concrete system	Patents	100%	1960
Dywidag - Aceros Sima S. A.	Dywidag-Dickerroff und Widmann A. G.	Germany	Prestressed concrete system	Patents	100%	(*)

Supercemento Vianinni S. A. (France-Italy)	Sentab, Svenska Entreprend A' Ktiebolaget, The Sentab Pressure Pipe Cons.	Sweden	Concrete pipes	Patents 3/	Partial	(*)
Chicago Bridge Arg. S. A. (USA)	Chicago Bridge & Iron Co.	USA	Metal structures assembly	Patents, technical asst'.	100%	1971
A. G. McKee & Co. Arg. S. A. (USA)	A. G. McKee Eng. & Const. Co.	USA	Engineering & construction services	Technical assistance. Computer programmes	100%	1964
Guillermo Billy S. A. (Argentina)	International Housing Ltd.	USA	Moulds for the construction of single family dwellings	Technical assistance & hire of moulds	Partial	1974
Garoebled S. A. (Arg.)	The Mitchell Construction Kinnear Moodie Group Ltd.	England	Methods for soft earth tunnel construction	Technical asst' and patented process	Partial	1972

---

a) In practice, this kind of agreement involved all sales since it is for the firm's overall operation.

1) Const. 104 - January 1954, p. 258.

2) Estimated date.

3) Sentab registered its patents in 1963 as a "method of manufacturing prestressed, reinforced concrete pipes". Patent N° 141.109, valid for 15 years.

* No information

Table IX.2 Technology Agreements (Expired in 1975)

Local Firm	Granter of Licence	Country of Origin of Granter of Licence	Object Transferred	Characteristics	Year of Contract
Cía. General de Construcciones S.A.	Berliner, Benweise	Germany	System for underpinning in large scale sewer works	Patents Technical assistance	1940
Patentes Toschi S.A.	Toschi SpA	Italy	Prefabricated concrete structures	Patents	1949
Marini y Varessio S.R.L.	(Dywidag) Dyckerhoff & Widmann A.G	Germany	Manufacture of concrete sleepers	Patents	1954
Atilos Volpi S.R.L. Messing y Cía. S.A.	R. Camus et Cé. S.A. Soc. d'Etudes et de Realisat. de Procedes Econ. de Const. (SERPEC)	France	System for housing construction	Patents	1953
Vialsa S.A.	Edmond Coignet et Cíe. S.A.	France	System for housing construction	Overall asst'. and patents.	1964
Crivelli-Cuenyo y Goicca S.A.	Rentobil Laboratories Limited	England	System against wall damp	Patents and technical assistance	(*)

Zarázaga y Degregorio S. R. L.	H. F. Leonhardt	Germany	Prestressed concrete system	Patents	1959
Vibrex Sudamericana	A. Hiley	England	Piles	Patents	1945/50 (approx.)
Adelphia S. A.	A. Salvi y C.	Italy	Manufacture of accesories for airlines and sub-stations	Patents and technical assistance;	1960/65 4/
Mellor Goodwin	Combustion engineering Inc.	USA	Construction of industrial plants	Designs and patents	1960 4/
SGAC, Soc. de Cementos Armados Centrifugados S. A.	Vianini SpA	Italy	Tubular concrete posts for electrical networks	Patents	1949

4/ Approximate years

(*) No information

domestic capital which drew up permanent technology agreements (or through long-term contracts) committed its whole turnover in royalty payments (Table IX. 3) 231/.

Table IX. 3 Foreign Technology Contracting

Kind of firm	Number of Contracts	Percentage	Licensing Total Sales	Licensing of Part of Sales
Foreign subsidiaries	12	57.1%	83.3%	16.6%
Local firms	9	42.9%	0	100.0%

Source: Table IX. 1

They only contracted specific processes. They have taken out licenses, for example, on systems for carrying out specific works or on processes for the manufacture and installation of components (pipes, concrete domes, prestressed concrete systems, drilling systems, etc.), but never complete or comprehensive technical assistance involving advice covering all and every one of the constructions they carry out. On the other hand, a rather different situation is observed in the case of foreign subsidiaries. With the exception of SADE, the large contractors of infra structure works have not committed all their turnover in permanent technology agreements, but, as we shall see later, have contracted only foreign technical assistance to carry out specific works. However, those who have drawn up this kind of agreement are firms which construct industrial plant (McKee, Austin, CBI) or firms involved in public works which manufacture and install premoulded parts (SCAC, Supercemento, Acueductos and Pilotes Franki) or sell essential specialized technical services (Rodio, Stup, Dywidag). That is, of the foreign subsidiaries which have a share in the public works market, those who have contracted foreign technology for materials essential to the construction itself, are specifically the firms which supply some essential material or process. On the other hand, foreign contractors have behaved in a similar fashion to the local firms, since

231/ We include Pretensac' S. A. 's turnover under EACA, which owns its shares and with whom it invoices almost all its sales. If we took it individually, it would be the only firm which pays royalties on all its sales, given that its only service is advice and sales of the BBRV method of prestressed concrete.

"they have tended to commit only part of their turnover in royalty payments.

Perhaps this is logically the only possible methodsof contracting in this sector since, due to the variety of works undertaken by a firm, and to their different volume and technical complexity, it is unlikely to require technical assistance covering all of them. For example, if it were to acquire a process of construction system, royalty payments should apply, unless there are restrictive market conditions, only to turnover related to the system itself, and not to total sales. We understand that this occurs essentially because construction firms rarely specialize in a very definite area. They generally diversify their works portfolio and simultaneously undertake technically different works. In addition, as these are not repetitive - therefore individual and not mass-produced - taking out a license on total sales can lead (and inevitably does) to works which may have simple technical solutions being committed to royalty payments 232/. This criterion, which apparently has its own internal logic, applies to some of the foreign firms, since if we analyze the "permanent" agreements, we can see that the majority (with the exception of Supercemento) of those who commit their total turnover to royalty payments are subsidiaries, who do so through contracts with their respective parent companies or with one of the group subsidiaries.

It can also be seen from Table IX. 3 that it is the multinational subsidiaries which tend to draw up the largest number of technology contracts with foreign firms (57. 1% of the total); a percentage which is higher if we bear in mind their low relative share within the total number of construction firms. That is, their tendency to license technology from abroad is significantly greater than that of local firms, which marks a real difference in behavior.

b) Purpose and Nature of "Permanent" Technology Agreements.

One of the facts which stands out when we analyze each of the agreements which led to foreign technology being contracted for a definite period of time, is the variety of ways in which contracting took place and the way it was exploited in the domestic market. If we were to attempt to establish a reasonably rigorous typology, it is likely that we should be faced with as many different ways as the number of contracts drwan up. Nevertheless, we have developed a classi-

---

232/ It is, of course, possible to take out licenses for building construction methods which may lead to mass production of parts. Only in those cases could licensing for total sales be accepted. However, the technological component is mainly included in the equipment, which would reduce the need to contract asssitance once it has been acquired.

fication which, while not the only possible one, may give us a reasonably accurate idea of the nature of foreign technology contracting. It shows the following characteristics:

i) agreements which grant the non-exclusive right to use a number of patents in the local market. The explanation lies, in our opinion, in the fact that it would be unprofitable for a firm to draw up exclusive agreements, since it would in this way subject its expansion to a maximum limit defined by the capacity values of the licensor. The non-exclusive right enables it to license to third parties and thus overcome one on the intrinsic restrictions of public tenders, in those cases in which the contracting limits of the local firm have been reached: A similar situation might be observed if the foreign firm were to make a direct capital investment: the restriction in this case would be its own capacity value, although it could exceed it and achieve a greater volume of the market in terms of the use of its patents), by licensing its processes to third parties 233/.

ii) agreements which make a clear distinction between the licensing of the patents and the know-how necessary for their use, which in practice involves, on the one hand, the freeing of a dependent process and, on the other, the handing over of the technical specifications necessary for its implementation. One of the possible explanations may be found in the unique character of each construction work: the firm which has taken out the patent may require, besides the usage rights, technical assistance for its use in specific works, since acquisition of the patents does not necessarily guarantee that it can be used 234/. Hence, in some cases, there are two simultaneous contracts which have led empirically to two overlapping royalty rates: one for the acquisition of the patent, and the other for the know-how necessary to undertake the works.

iii) Firms established in the local market in order to make use of their patents through licenses to third parties, but without becoming directly involved in construction. Strictly, speaking, they are firms which only marketed a technological service, without having developed an industrial plant - like a typical manufacturing firm - nor having acquired equipment which would allow them to become di-

---

233/ Two processes for the manufacture of prestressed concrete pipes and a prestressed concrete system were introduced by this kind of non-exclusive licensing. In the case of concrete pipes, for example, parallel to their agreements with Acueductos S. A. and Jaime B. Coll S. A., Tubos Bonne of Spain licensed Becea S. A. to use the same patents and procedures for the drinking-water distribution system in Bahía Blanca.

234/ This is emphasised by the fact that, in the case of large scale works, there are different technical demands, which can be seen in several contracts which have granted the rights to use the patents and the technical assistance necessary to carry out sanitation works: this is the case, for example, with the agreements between Supercemento and Vainini and between Acueductos and Materiales y Tubos Bonna.

rect contractors. Their activity has centred on trading a patent, so that their market performance is directly related to the relative advantages of their own technology 235/.

The inherent characteristics of the construction sector mean that patenting is always related to building methods and processes - since there is, of course, no product to be patented -. The firm which has developed a technology can make use of its advantages by using its processes and not closing the market to potential competitors. Therefore the firm which has developed its own construction method or process tends to establish itself as an independent concern in order to market its proprietary knowledge, which would otherwise be pushed out by competitive systems 236/.

iv) license agreements which do not transfer technological assets, but are undertaken to expand the local firm's domestic market.

In all cases, these contracts were drawn up between parties from the same multinational corporation and through them the parent company commits itself to obtaining work contracts among the firms which, in their own country, have subsidiaries in the market in which its branch firm operates. Thatis, they are agreements which succeed in obtaining dependent work contractors through a possible direct acquaintance between the parent companies of corporations which operate domestically. In practice, this is a trade rather than a technology contract, even if the latter name is applied to it 237/.

235/ Formally, the license agreement is effected between the parent company and its local office, which in some cases acts as a foreign subsidiary: the local office has its balance sheet included with that of its parent company, and its transactions are considered as imports. Specific examples are Dywidag and STUP (Campenon Bernard).

236/ In the case of prestressed concrete, there are situations (STUP., for example, in which the local firm, in order to expand its market, undertakes some of the technical studies for a project, so that it acts as a technical agent and succeeds in replacing the other substitute systems. In this respect, the firm makes use of its technological advantages without taking on the functions of a construction firm. since it operates mainly as a technical office for the promotion of its own process, developed abroad.

237/ The clearest example in this respect is probably SADE, which drew up agreements with Sadelmi Co. and the Export Division of General Electric Co., both of the U. S. A.. At a lower level, we could also mention the contract between Chicago Bridge Argentina and its parent company.

v) foreign technical assistance contracts drawn up by construction firms, not in relation to one or several, but in order to tender in a very specific submarket. This kind of agreement has been entered into mainly by firms backed by domestic capital, in order to cover technical requirements specified by the client institutions - in some cases with considerable precision. In practice, they are undertaken by firms which do not cover minimum capacity and experience levels, so that they try to cover their deficiencies through foreign contracting 238/.

vi) technical assistance agreements by which a firm commits all its turnover, and simultaneously undertakes technology contracts for specific works. Here two agreements relating to the same work overlap and lead to the payment of double royalties. With regard to the cases analyzed here, this situation appears only in contracts drawn up by members of the same multinational corporation and relating particularly to industrial construction 239/.

vii) finally, there are also agreements for technical assistance concerning assets which were simultaneously capitalized by the licensing firm. That is, technological agreements which are included as a further share of the local firm's declared capital. This kind of contract is always drawn up between subsidiary and parent company, and naturally involves royalty payments for the service transferred 240/.

c) Distribution of Contracts by Kind of Work.

From Table IX.1 it is fairly clear that "permanent" foreign technology contracting has occured in very specific areas. For example, there are no contracts related to housing construction (with the sole exception of the Outinord system, the use of which is today practically irrelevant) or electromechanical works or paving construction. Where it does have greater importan-

---

238/ The agreements drawn up by Gardebled S.A., Criba S.A., Construcciones La Plata S.A. and EACA-Pretensac S.A. can be explained by this kind of argument.

239/ An example is A.G. McKee, which, after drawing up an agreement in which it committed its total sales to royalty payments to its parent company, also entered into partial agreements to carry out the extension of the Somisa S.A. plant.

240/ 7,8% of the capital of Austin Sudamericana consisted of the technology which, according to its parent company, it contributed to the firm. At the same time as this capitalization, a contract for the provision of technology was drawn up between the parent company and the subsidiary which has been in force since 1966.

ce is in the manufacture and installation of large concrete pipes for sanitation works or in the execution of industrial works. It is in this sub-market that a special situation is observed, since only the foreign firms backed by American capital contract permanent foreign technical assitance, doing so exclusively with their parent companies and committing their total sales 241/.

A third area in which foreign licensing assumes greater importance is when basic systems are contracted (prestressed concrete, special drilling or piling), which can be used in different kinds of works, but which do not constitute contracting at sub-market level, since they are concerned only with some of the technical materials of processes central to the execution of the constructions in which they are used. These areas show that essentially the "permanent" agreements have not tended to incorporate processes which relate only to one kind of work, but which reflect the introduction of processes which generally have multiple applications.

Now if we took it as our basic premise that foreign technology contracting occurs in areas which do not have their own technological capacity; that is, that each contract is established because of a lack of technology, from Table IX. 1 we would note that local deficiencies are reflected in the areas we describe in Table IX. 4 242/.

If we analyze each of the transactions and the kind of sub-market to which the firms contracting foreign technical assistance belong, we can see whether such technology lacks of are the result of real local deficiencies or if they merely reflect transactions which involve objectives other than the transfer of technology 243/. In order to do this, we shall examine four aspects which in the first instance will allow us to verify whether or not there is a lack of technology:

i) The level of local competitiveness, which may be reflected in the fact that there are firms in the market which, without contracting foreign techno-

---

241/ Its technological licensing is carried out simultaneously whith its direct capital investment which, as we described in Chapter III, corresponds to the fourth stage of establishment of foreign firms whose predominant feature is the entry of industrial plant construction firms of American origin.

242/ In practice, testing deficiencies also involves analyzing whether the agreements imply a transfer of technology or whether they can only be classified according to a marketing criterion.

243/ The information comes from licensing agreements in force as at 1975. For this reason, the apparent deficiencies also corresponds to the year of operation of each contract.

gy, compete perfectly well in the area of operation of firms which have taken out foreign licenses. In these cases, the contract does not, of course, give evidence of local deficinecies. One way of proving this, is through the position of the licensing firms with regard to domestic tenders. They have not always managed to offer the lowest tender price for strict technical conditions imposed by the client, and have been pushed out by both local firms and foreign subsidiaries 244/. It is not surprising that this refers to all construction firms which have taken out foreign licenses which commit their total turnover to royalty payments. That is, all the firms which apparently receive technical assistance for each and every one of their works.

ii) If the duration of the contract extends over a long period of time unrelated to that which could reasonably be ascribed to the development of local learning. It can be considered that the period required for assimilation of a process by members of a firm in never more than 10 years - a figure in itself extremely high -. Payments for technical assistance in the same way as payments for patents, can only be justified during the years when a firm is initially being set up or when a new product is being launched (the legislation itself grants an operational period which rarely exceeds 15 years). If royalties continue to be paid once the learning process is completed or the patent has expired, the economic reasons for the transaction logically fall under a different heading from that of a true of technology.

In this case, we have discovered that approximately a quarter of the agreements correspond to contracts drawn up a considerable time ago: for example, three of them have been in force for more than two decades - one was drawn up in 1935 - and other four are about 10 to 15 years old (Table IX.5) 245/.

244/ In this connection see Informaciones, Cámara Argentina de la Construcción, Resultados, N° 280 to 330, Buenos Aires.

245/ Some authors consider that certain agreements are kept up for a longer time because they simply protection of trademarks. This point, which we shall examine later, is not valid in this sector since trademarks do not operate as an effective advantage in the market. Likewise, the United States Senate suggests that "for strategic reasons, large semi-monopolistic firms (a characteristic of the important MCs) will place new products on the market only when former products cease to produce reasonably profits. If a firm is technologically superior to its foreign competitor overseas, it will try to depay the transfer of its first line technology to its own subsidiaries until: a) a slightly older technology stops producing a satisfactory sales growth; or b) the competition by foreign firm forces it to introduce the new technology as a means of protecting its market share". Taken from Informe del Comité de Finanzas del Senado de los Estados Unidos, op. cit. pp. 115 and 116.

Table IX. 4 Areas in which Foreign Technology Agreements were drawn-up

Works	Industrial	-Complete industrial plants -Metal structures for industrial plants	- Austin Sudamericana S. A. U. S. A. - Arthur G. McKee (USA) - Chicago Bridge & Iron Co. (USA).
	Sanitation	-Manufacture of pipes for large conduits -Installation of large pipelines	- Acueductos S. A. Francia (Spain) - Jaime B. Coll S. A. (Argentina)
	Roadworks (Bridge constr.)	-Bridges & large works of art	-CRIBA S. A. (Argentina)
	Silos	- Silo Construction	- Cía. Sudamericana de Silos (Argentina)
	Housing	- Building methods	- Outinord Americana (France)
Systems or Components	Prestressed	- Prestressed syst.	- STUP - Francia - Dywidag - Germany - EACA - Pretrensac (Arg.)
	Drilling	- Special drilling	- Rodio Arg. S. A. (Switzerland) - CRIBA (Argentina)
	Piling	- Piles	- Pilotes Franki S. A. (Belgium)
	Premoulded materials	- Concrete shells structures - Reinforced domes	- SCAC (Arg. -Italy) - Constr. La Plata S. A. (Arg.)
	Adm. & marketing systems for const. firms	- Acct'. advice Computor use - Contracts seeking	- SADE S. A. (USA-Italy) - Chicago Bridge & Iron Co. (USA)

Source: Table IX. 1

Table IX. 5 Age of Technology Agreements in Force in 1975

Year drawn up	Before 1939	Between 1940-45	Between 1946-50	Between 1951-55	Between 1956-60	Between 1961-65	Between 1966-70	Between 1971-75
Number of contracts	1	-	-	2	2	2	5	7

Source : Table IX. 1

iii) If contracting is carried out in areas in which the apparent transfer of knowledge relates to subjects which because of their nature were developed from the outset by local institutions. This refers mainly to contracts for administrative and accounting assistance which are rarely drawn up because of local lack of ability or deficiencies. Furthermore, the same accounting systems are widely known in this country and it is practically impossible for a firm not to be able to look to local personnel or freely available systems not involving royalty payments.

iv) When it is difficult to identify from an analysis of the contract what is being trasnferred. They are to some extent vague agreements in which there is no precision regarding the asset received, which allows it, a priori, to be disputed precisely because of its vagueness.

Usually, when a technical assistance agreement has one of these four characteristics, it is unlikely to be giving evidence of technical deficiencies. The payments can be considered as net overseas transfers which do not, in themselves involve the introduction of new technological assets.

Of course, this situation leads to a redefinition of areas, which on a first reading expressed local deficiencies. The inherent reasons behind each agreement enable us to discount some of the transactions, which in many cases have not reflected real technological advantages but basically a subsidiary-parent company relationship.

From our point of view, the firms which have obtained advantages in the local market on the basis of their foreign technology contracts, - committing all or part of their turnover for a specific lenght of time - operate, not as construction firms, but as suppliers of a product or service (such is the case of Rodio, STUP, Pilotes Franki, Acueductos, Pretrensac or SCAC). The construction firms, on the other hand, have obtained no clear advantages which might have arisen from their foreign

technology contracts relating to a specific kind of work. Their situation was different when they contracted technical assistance for the manufacture of a specific item, although we could not state categorically that they thus managed in practice to have a major effect on the market (Construcciones La Plata, Conevial-Sebastian Maronese or Criba S.A.). In this way, our table of instances of an apparent lack of technology is substantially modified and tends to discount particularly those agreements whose technological assets do not reflect the incorporation of essential processes or materials, when these do not make up the total turnover of a construction firm 246/.

d) Reasons which explain "Permanent" Foreign Licensing.

In the previous section we stretched one of the most important reasons for foreign technology contracting by local firms. This usually happens in areas in which the foreign firms have technological advantages arising from their scale of operations or from the time they have had for learning since their first technical developments. In previous chapters we also stated that when the client demands proven systems, it is foreign firms which have the advantage over local ones. For this reason, one of the ways of overcoming this barrier is by contracting technology from abroad, as long as it involves no explicit research support or changes in the client's behaviour. In those cases, the ability to excute the work and the accumulated knowledge constitute entry barriers for local firms which must turn to foreign licensing to overcome them 247/.

Contracting is based chiefly on a specific requirement by the client: he requires proven systems whose experimental costs must be borne by firms which do not always have the financial resources to undertake large scale expenditure. Generally, when a local firm is faced whith the alternative of carrying out its own technological research or taking out a foreign license, it bases its decision, among other things, on the cost differences related to time which one or the other alternative may involve, or on the possible need to overcome entry barriers arising from dependent knowledge. At the micro- or company - level, there may be a preference for taking out foreign licences, since the major cost of a research project lies mainly in the initial period (which means tying up a considerable volume of funds at a particular moment). On the other hand, importing technology enables firms to spread their costs over time, the influence of which will depend, of course, on the royalty rate. In this respect, the risk involved in research may be grater - expressed in terms of costs - than that connected with the importing

---

246/ We summarise these conclusions in Table IX.9 at the end of this chapter.

247/ Examples are, at the risk of being repetitive, prestressed concrete special drilling, and large conduits for sanitation works.

of technology; or, from the other point of view, the overall finance required may be less 248/. This is, perhaps, together with the previous one, another of the reasons why local firms have contracted foreign technology.

The need to overcome entry barriers which might arise from proprietary knowledge is probably less relevant. We observed in Chapter VII that the nature of the construction industry limits the possibilities of using the patents systems to block production or prevent the entry of new firms. We noticed chiefly that the benefit of the patents does not here arise from their blocking capacity, but from their use, which is confirmed to some extent when we analyse the licensing agreements drawn up by local firms 249/.

At another level we find the firms backed by domestic capital which contracted technologies that had been successful abroad, in an attempt to improve their market position, and not because of requirements arising from strict specifications set down by the client. They have not usually gained significant advantages and several firms failed to achieve their objective (as in the case of Vialsa S.A., which contracted Edmond Coignet's French method of housing construction, or Pueyrredón Construcciones which contracted the Outinord method). The reasons have mainly to do with the different market conditions which exist in the two countries (relative prices, continuity of demand and access to credit, as principal variables), and possible difficulties of assimilation, arising from physical deficiencies (Input endowments) or from technical difficulties inherent in each firm's structure, are irrelevant.

In short, it can be concluded that technological licensing undertaken by local construction firms (regardless of the origin of their capital) has not been important with regard to contracts by which they committed - over time - all or part of their sales (naturally without any specific works being identified).

When the latter situation arises, we encounter the second way in which technological licensing takes place in the sector, which is contracting related to specific works.

248/ Various authors have also shown that the minimum investment volumes for research and development projects are usually very high in relation to the size of domestic firms. See, for example, F. Fajnzylber, op. cit.

249/ Another reason which is normally offered to expalin why local firms drwanup license contracts is the formulation of trademarkagreements (something which is common in several branches of the manufacturing sector). In our case, construction firms almost never operate in markets in which trademarks play a predominant role in orienting the preferences of the contracting firms, so that this cannot be considered to be an explanatory variable.

2). Incorporation of Foreign Technology for Specific Works.

Generally speaking, there are four different ways in which this kind of contracting has come about: first, technical works usually carried out by consultants independent of the final contractor have been negotiated, that is, agreements to carry out the stage prior to the project's being tendered). Second, technical assistance contracts for the execution of the project have been drawn up, that is, a kind of product level agreement; third, contracts for the execution of specific parts of the work and finally, we can include in a forth category contracts arising from technological licensing relating both to the plans and the work itself (that is, a kind of overall technical assistance). In this case, the constructions which have been carried out in this country using foreign technical assistance are listed in Table IX.6.

One of the basic conclusions which can be drawn from an analysis of the agreements relates to the specific characteristics of each of the licensed works: when foreign technology was contracted for the execution of a particular work it was always for constructions in which the technological component was vital and of a unitary volume not previously undertaken. Of course, these two aspects are inextricably linked and part of the same phenomenon: the unique nature of each construction.

From another point of view, this fact confirms our hypothesis that there is no need to arrange for foreign technical assistance which commits the whole of a contruction firm's turnover, since practically all the firms which contracted assistance for one or other of their works, at the same time undertook others for which they used their own technological assets. That is, they called, at the same time, on both local and foreign engineering.

Another significant fact arises from the kind of firms which formulated the license contracts: their description shows that over 90% of the agreements were arranged by foreign subsidiaries which preferred to call on their parent company pany for this service (Table IX.7).

Table IX.7 Contracting of Technology for Specific Works

Contracts Executed	Number of Contracts	Percentage of total	Drawn up between subsidiary & parent company		With third parties	
			N° of cont.	%	N° of cont.	%
Foreign subsidiaries	20	90.9%	11	55%	9	45%
Local Firms	2	9.1%	-	-	-	-

Source: Table IX.6a

Note: we do not include the contract for the preparation of the plans for Yaciretá-Apipé, since the work is administered by a bi-national institution.

Table IX.6a. Works carried out with Foreign Technical Assistance

Work	Local Contractor	Licenser	Links between licenser & Licensee	Subject of Contract	Year
Chaco-Corrientes Bridge	Impresit-Sideco S.A.; Umberto Girola (Italy) Ferrocemento SpA (Italy); Impresit SpA (Italy)	Impresa Ing. Lodigiani SpA (Italy)	Impresit-Girola & Lodigiani make up Impregilo	Asst'. for prefabrication of supporting blocks & beams for the bridge structure. Overall technical advice for bridge construction.	1969
Chaco-Corrientes Bridge	do.	Impresa Costruzioni Generali Ing. Rechii Turín (Italy)	?	Overall technical assistance for bridge construction	1969
Chaco-Corrientes Bridge	do.	Geosonda SpA (Italy)	Impresit owns the share capital of Geosonda	Advice on the prefabrication of casings for the underwater posts and their installation with steel by means of vibrators	1969
Chaco-Corrientes Bridge	do.	Soc. d'Etudes et d'Equip. d' Entreprises (France) ★	NO	Preparation of plans and technical assistance	1969

★ It belongs to Societé des Grands Travaux de Marseille

Zárate-Brazo Largo Bridges	Techint S. A. y Horacio O. Albano S. A.	Impresa Ing. Lodigiani SpA (Italy)	NO	Overall technical advice for construction of bridges and viaducts	1970
Zárate-Brazo Largo Bridges and Viaducts	do.	Italconsults (Italy)	-	Carrying out project	1970
Fiat-Concord Pressing Plant	Techint S. A. (1)	Belmas-Mass (1) (USA)	NO	Technical assistance	
Petrosur Fertilizer Plant	Techint S. A.	Mitsubishi Heavy Industrias (Japan)	NO	Technical assistance for detail engineering carrying out civil eng. projects & installation assembly	1966
Extension to Altos Hornos Zapla Thermoelectric Station	SADE	Brown Boveri CIE (Switzerland)	NO	Transfer of formulae plans, diagrams, operating manuals	1971
Chocón-Cerros Colorados	Impregilo Sollezo Hnos. Dragados y Constr. S. A. Auxini Roggio Dragados	Impresa Ing. Lodigiani SpA (Italy) Impresit SpA	Subsidiary parent company	Overall advice	1968
Chocón-Cerros Colorados	do.	Sir Alexander Gibb & Portners (England)	NO	Drawing up of plan	1966-1968

El Chocón	Impregilo, Sollezzo Hnos.	Ing. Lodigiani SpA Impresse Italiane All' Estero SpA	Subsidiary parent company	Overall advice	1968
Salto Grande	Impregilo Sollezo Hnos. Impresit Sideco Palrnga S. A.	Impresa Ing. Lodigiani (Italy) Impresit SpA	Susidiary parent company	Overall advice	1974
Salto Grande	do.	Main Assoc. (USA)	NO	Overall advice	1974
Santa Fe Paraná Underriver Tunnel	Hochtieff A. G. Vianini SpA	Hochtieff A. G.	Subsidiary parent company	Overall advice	1970
Fray Bentos Puerto Unzué Bridge	Dyckerhoff & Widmann A. G. Hochtieff A. G. SADE Entrecanales y Tavora	Tudor Eng. Co.	NO	Execution of plan and advice	1972-1976
Fray Bentos Puerto Unzué Bridge	do.	Dywidag-Dyckerhoff & Widmann A. G. (Germany)	Subsidiary parent company	Overall advice for the work	1972-1976
Yaciretá Apipé	-	Herza Lahmeyer (USA-Germany)	-	Drawing of plans	1975
Extension of Soc. Mixta Siderúrgica Arg. S. A. Somisa	Arthur A/G McKee	A. G. McKee Eng. Co. (USA)	Subsidiary parent company	Overall advice	1975

General Mosconi Petrochemical Plant	A. G. McKee-Tecsa	Soc. Hamon-Degremont S. A. (Belgium)	NO (*)	Concrete water cooling tower (Plans and computor programme)	
Ford Argentina S. A. (Extension to Pacheco plant)	Austin Sudamericana S. A.	Austin Co.	Subsidiary parent company	Use of "Tilt-up" building system, developed and patented in the USA in 1976	
Futalelfú	Tecnoproyectos S. A. Consultora	Electro Watt Elektrische & Industrielle Unternehmung (Switzerland)	NO	Plans, calculations and diagrams	1970
Futalelfú	Vialco S. A.	W. P. System A. B. (Sweden)	NO	Overall technical advice. Selection of work methods Drilling and supply programmes	1970

Table IX. 6b.

La Florida Dam	-	Sistema Noetzli (Patentes)	-	Patents and technical specifications
Cruz del Eje Dam	-	Sistema Noetzli (Patentes)	-	Use of system (The Dam is approximately 40 m. high)
Escaba Dam	Sollazzo Hnos.	Ambursen Don Co. (USA) (diseño) Joint Committe on Standard Specifications for Concrete and Reinforced Concrete (USA) (Cálculo de hormigón armado)	NO	Plans and technical assistance
Laguna Setubal Bridge	Christiani y Nielsen S. A. Pilotes Franki S. A.	Europe Etudes (France) STUP (Suc. Arg.) y Pilotes Franki)	YES	Plans
Castaño Viejo Mining Company	?	Rossacometta SpA (Italy)	?	Use of systems (patented) for construction of building and dwellings

SNIAFA S. A. Industrial Plant	Polledo S. A. SALE SRL	SNIA VISCO S. A. (Italy) Y. Valtolini (Italy)	NO (The link is between the industrial firm the licenser)	Plans for industrial plant, including the civil eng. projects	
Celulosa Argentina	-	Blaton Aubert (Belgium)	-	Plans for carrying out the civil eng. works 1/	
Los Molinos Dam	Sollazzo Hnos.	Ing. S. E. Fitz Simon	NO	Plans and advice	
Bridge over Arroyo Leyes	Geopé (Germany)	W. Wagner Manslen (Germany)	?	Overall Plan	1942

Note: In Table IX. 6a we have included the works which have been carried out with foreign technical assistance during the last ten years, whereas in Table IX. 6b we describe some of those which used both patents and outside advice in previous periods. The difficulties involved in obtaining the latter information has, we believe, caused the table to be incomplete.

Source: Author's research

In previous chapters we observed that the foreign firms are usually located at a very special level in each sub-market, corresponding to works with a large unitary volume and involving a relatively high degree of technical complexity. It is precisely these constructions which have mostly been carried out, during the last ten years, by foreign subsidiaries and in which technical assistance, also from abroad, has been employed.

In this way the different capacity of each subsidiary to achieve greater work volumes over time - which arises from the kind of advantages we examined in chapter V - is so strongly reinforced by the possibility of its including part of its corporation's technological capacity. This advantage does not come from the internal structure of each of the subsidiaries but from the technological stock of the parent company. In other words, the advantage lies within the corporation as a whole, on which the subsidiary may call when a technically complex work appears on the market. When this does not occur, they carry out other works with their own technological assets, competing in practice with local firms. In this respect the divisions we described for each sub-market in chapter IV also overlap with a clear stratification by kind of work, according to the origin of the technology.

Within this framework, which can be characterised as of temporary transfer of knowledge, we shall next examine the characteristics of foreign technical assistance contracting for the works described in Table IX.6a. From an analysis of this table it can be stated that:

i) All large public works carried out under foreign licensing have required, as a minimum, two technological contracts: one for the preparation of the plans (preferably undertaken by an engineering firm) and another for the execution of the work, usually drawn up between subsidiary and parent company. The latter situation arises partly from a legal demand for payment for the technical services rendered by the firm receiving the contract as long as the latter is established abroad;) a technological contract must be formulated in order to authorise payments. Hence a draft for technological royalties may provide evidence of its technical services.

ii) In the case of large public works undertaken by a mixed joint venture - that is, with participation of both local and foreign firms - it has always been the main contractor who has drawn up the technology agreements with the parent company. The firm backed by local capital has usually been included because of restrictions in the tender specifications, and it has rarely made a significant technological contribution. It would be logical to think that, if it had itself had the technical capacity to do so, it would have tendered individually - or as the main contractor -. However, it can validly be stated that, on completion of the work, it may have enhanced its experience and improved its market entry capacity because of both an increase in its relative turnover level and the actual accumulation of knowledge as a result of its direct participation in the work.

iii) There is an overlaping of technology contracts which has allowed the firms granting the license to remove the resctriction on maximum royalties laid down in the law on technology ratified in 1973. There are also cases in which contracts referring to the same service (that is, they transfer the same technological asset) are drawn up simultaneously, thus providing a royalty rate above the maximum allowed.

iv) All contracts for specific works have been concentrated in three different areas: a) in the construction of hydroelectric systems, b) in the execution of large works of art (bridges) and c) in the construction of industrial works. The latter area is largely influenced by contracts tied to conditions imposed by whoever delivered the engineering plant.

v) If we bear in mind all foreign licensing (according to both kind of work and to permanent or periodic licenses), we see that the firms which have used foreign technology contracting were usually subsidiaries of multinational corporations. Approximately 60% of the subsidiaries which operate in the local market, today have license contracts with foreign firms, whereas local firms have made use of such contracts to a significantly lower degree. On the other hand, when contracting was undertaken by foreign subsidiaries, the technological assistance preceeds in all cases from sources established in the subsidiary's own country of origin, and preferably from the firms associated with it, (Table IX. 8). That is, the capacity to negotiate and/or seek alternative sources of technology is significantly reduced when the firm in receipt of the license is backed by foreign capital and the imperfections of the technological assets market are further accentuated.

3. Different Levels of Foreign Technology Contracting in each Sub-market (Permanent and Specific Works licensing)

In general, our analysis shows that foreign technical assistance relating to both specific construction works and individual firms is concentrated in very limited areas. Apart from some very precisely defined processes which it requires long practical experience to use, or works in which technical complexity or tied contracts require foreign licenses, it is unlikely that the remaining kinds of construction works can be carried out with domestic technologies. In housing construction, for example, where relatively simple and widely known craft methods are used, the introduction of new technologies has been influenced to a large extent by irregularities in demand or by the physical characteristics of the building process and not by foreign technological developments. The same thing happens with roadworks (both highways and urban paving) or sanitation works or lighting. Only the structure and volume of the equipment used in them restricts the contractor's field of operation and there is no technological requirement which affects their entry into the market.

The technological variables does not explain relative advantages between firms in these cases, since the chief restriction is financial (both regarding

their own resources and their ability to obtain credit, and their equipment endowment).

On the other hand, in technically more complex works (large scale road systems or hydroelectric constructions), the contractors' accumulated experience operates as an important entry restriction. This experience becomes necessary because the tender specifications make each firm's application depend on the background they have accumulated in the market. Usually, large projects involve carrying out individual works which are unlikely to resemble previous ones. Furthermore, during construction, the contractor must face new problems, which arise from the unique nature of the construction work and which can only be resolved by means of the technological assets a firm accumulated in its technical and organizational structure. In this respect, it is natural that when these demands increase, the probability of technical assistance contracts appearing is considerably greater.

But there is a broad area which covers building construction, industrial construction, roadworks (except for large works of art), sanitation, and some electromechanical works, in which local firms have engineering capacity of their own, and do not have to call on outside assistance (see Table IX. 9).

On the other hand, in the areas where it has been used, contracting has occured for two kinds of reason: on the one hand, because of real technological deficiencies and on the other, because of possible conditions imposed by the contract itself or special tender specifications which can badly be put under six headings: 1) because of the calling of international tenders for the drawing up of plans; 2) because of the calling of tenders for execution of the work 250/; 3) because international bodies impose as a condition the contracting of foreign advisory services 251/; 4) because of financial obligations arising from the tender specifications

---

250/ Both this and the previous section illustrate the level of local competitiveness.

251/ The International Federation of European Building and Public Works Contractors considers that International Bodies are the real agents of international expansion of consultancy services. "After the war", it says, "an important factor in international competition, as it is understood today, has been the creation throughout the world of various international agencies (...). At the appropriate time the World Bank set out its own procedures which had been imposed on the beneficiary countries. In these procedures, it is mainly a question of the employment of consulting engineers and competition is encouraged in order to make the best possible use of the available financial resources". In this way "the activity of the international organizations," it continues, "has stimulated a demand for studies in the international market of a magnitude difficult to imagine five or ten years ago." Taken from L'entreprise européene, Revista de la Federación Internacional de Contratistas Europeos de Edificación y Obras Públicas, 1st three months of 1971, N° 69, p. 58.

(demands for financial endorsement which, if given by foreign sources, may decide whether foreign advisory services participate or not); 5) because of the introduction of more complex works, which in volume bear little relation to previous ones and for which the client limits planning and execution of the work to firms with similar previous experience; and 6) because of ties arising from turnkey projects (mainly industrial) which involve foreign technical assistance contracting for the execution of civil engineering works.

These reasons partially explain the drop in participation by local engineering in the execution of large infrastructure works. Until the sixties, domestics firms competed on a relatively equal footing with foreign subsidiaries (this can be confirmed by comparing Table IX.10 with the information in the appendix to Chapter III), but from the time when large dams (of the size of el Chocón - Cerro Colorados or Salto Grande, for example) or the Mesopotamian link-up systems were undertaken, their participation has been more in order to comply with legal requirements imposed by the clients (compulsory participation of a local firm, for example) than to form a joint venture in which its role is significant 252/.

252/ A very controversial case like that of the construction of the Futaleufú dam, carried out by a local firm because the tender was restricted to domestic firms, shows that to undertake it the contractor had to call on contracts for foreign technical assistance to give support to its local teams. This example, because of the work's importance and the kind of corporations which tendered for El Chocón and Salto Grande, probably shows that local technical capacity reaches a ceiling when the work exceeds, in the case of hydroelectric works, the vicinity of 500.000 kw. generating power. On the other hand, the kind of firms undertaking the different Mesopotamian interconnecting road systems show, by the quotations for each tender, that the subsidiaries of multinational corporations, or their parent companies directly, have a capacity which has in some cases enabled them to make a significantly lower quotation than local firms. Nevertheless, this situation does not allow us to assert that there is no domestic technical capacity to carry out this kind of work; it may be stated, however, that the technical capacity of foreign firms is apparently accompanied by the advantages analyzed in Chapter V.

Table IX.8. Relation between origin of Capital and Technological Licensing (Construction Sector)

Product or Service	Country of Origin of Capital of Licensing Firm	Country of Origin of Technology Introduced	Parent Company Subsidiary Contracting
Technical advice for industrial plant constr.	U.S.A.	U.S.A.	Yes
Prefabricated concrete materials for tunnel facing	Argentina	Englan	-
Saddles and projections for bridge construction	Italy	Italy	Yes
Drilling and cement injection	Switzerland	Switzerland	Yes
Bridge building system	Argentina	France	-
Horizontal tunnels	Argentina	Spain	
Silo construction	Argentina	Liechtenstein	-
Reinforced concrete domes	Argentina	Italy	-
Premoulded piles	Belgium	Belgium	Yes
Prestre ssed concrete pipes	Spain	Spain	Yes
Steel box beams	Italy-U.S.A.	Bahamas-U.S.A.	No
Engineering serveices and building	U.S.A.	U.S.A.	Yes

Assembly of metals structures	U.S.A.	U.S.A.	Yes
Solid concrete slabs	Argentina	Germany	-
Anti-damp electro-osmotic systems for walls of building	Argentina	England	-
Prestressed systems (4 different ones)	France Argentina Italy Germany	France Switzerland Italy Germany	Yes - Yes Yes
Prestressed concrete shells for roof construction	Argentina	Germany	-
Administrative and accounting services for a building firm (*)	U.S.A.	U.S.A.	Yes

(*) The same firm undertakes two contracts for the same kind of service, with two different firms which belong to the same multinational corporation.

Source: Tables IX.1 and IX. 6a.

Table IX.9 Contracting of Foreign Technology in Each Submarket

Sub-market	Kind of Technology Contracted	Work Volume Carried out with Foreign Technology	Commets
Housing	Complete construction methods	Marginal. Today the use of construction methods licenG sed from abroad is practically nil.	-
Roads and urban paving	No contracting of foreign technology	Nil	-
Roadworks	- Prestressed concrete systems	- Practically all works which use prestressed concrete systems are carried out by processes licensed abroad	When a foreign firm carries out a work. it uses its own technology. Because of the the stipulations of local legislation, thi this situation requires the drawing up of a contract for the transfer of technology
Bridges	- Contracting of overall technical assistance for the construction of large scale works.	- Recently large volume works undertaken by subsidiaries of multinational corporations have been carried out by contracting foreign technical assistance to draw up the plans and execute the work.	
Sanitation Works	Patents for manufacture and installation of prestressed concrete pipes.	Marginal	There are in this country substitute technologies which have been developed locally. They have been used successfully.

Industrial construction		- Compete construction methods	- From 1960 there has been an increase in the number of industrial constructions carried out by foreign firms which contract technology from overseas.	The firms which contract technical assistamce from abroad use this mechanism not as an effective transfer of technology but as a means of transferring liquid funds abroad. In this respect, it can be stated that the need to use foreign technologies in this submarket is practically nil.
		- Assembly of metal structures	- It is marginal for the assembly of metal structures.	
Electro-mechanical works	Primary & Secondary lighting networks	No contracting of foreign technology		-
	Electric power generating plants	Contracting of overall technical assistance for the construction of large scale works		-
	Railway construction	No contracting of foreign technology		
Transport systems	Underground railways	- Prefabricated concrete		
	Polyducts	No contracting of foreign technology		

Piling	- Technical assistance for pillot manufacture	The market is controlled by firms which contract technical assistance with their respective parent companies	One of the firms has a contract which has been in force for 41 years
	- Drilling and cement injections	Marginal	Only these two products are made with processes abroad.
Premoulded materials			

Table IX.10. Public Works Built by Domestic Firms and/or by Administration

Construction work	Firms or Public Department which Undertook the Construction	Year
La Viña Dam (reservoir's capacity 230 km^3)	Sollazo Hnos,	1939/44
Los Alazanes Dam (reservoir's capacity 280 km^3)	Dirección de Hidráulica de la Prov. de Córdoba,	
Cipolletti Dam	Petersen, Thiele y Cruz	1942/44
Uruguayana Bridge - Paso de los Libres (Argentine Sector)	Administración General de Vialidad y Parodi y Figini S.R.L.	
Escaba Dam (Tucumán) (reservoir's capacity 126 km^3)	Sollazo Hnos.	
Presa El Carrizal	Sollazo Hnos.	
Central Nihuil (Mendoza) N°1	Sollazo Hnos.	
Central Nihul (Mendoza) N°3	Conevial S.A.	
Pueyrredón Bridge (over the Riachuelo)	EACA (Empresa Argentina de cemento armado)	1971/72
Paysandú Bridge - Colón	EACA (Empresa Argentina de cemento Armado)	1973/76
Valle Grande Condensator Dam (Río Atuel)	Sollazo Hnos,	1963
Cloacas Máximas de la Capital Federal (tramos)	Polledo S.A. y Arienti y Maisterra S.A.	

Source: Author's research.

Este libro se terminó de imprimir
el mes de Octubre del año 1978
en MIMEOGRAFICA
Viamonte 2358 - Buenos Aires -