

CEPAL

Review

Executive Secretary of ECLAC
Gert Rosenthal

Deputy Executive Secretary
Carlos Massad

Director of the Review
Aníbal Pinto

Technical Secretary
Eugenio Lahera



UNITED NATIONS
ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN

SANTIAGO, CHILE, APRIL 1990

The Secretariat of the Economic Commission for Latin America and the Caribbean prepares the *CEPAL Review*. The views expressed in the signed articles, including the contributions of Secretariat staff members, are the personal opinion of the authors and do not necessarily reflect the views of the Organization.

LC/G.1613-P

April 1990

Notes and explanation of symbols

The following symbols are used in tables in the *Review*:

Three dots (...) indicate that data are not available or are not separately reported.

A dash (—) indicates that the amount is nil or negligible.

A blank space in a table means that the item in question is not applicable.

A minus sign (-) indicates a deficit or decrease, unless otherwise specified.

A point (.) is used to indicate decimals.

A slash (/) indicates a crop year or fiscal year, e.g., 1970/1971.

Use of a hyphen (-) between years, e.g., 1971-1973, indicates reference to the complete number of calendar years involved, including the beginning and end years.

Reference to "tons" mean metric tons, and to "dollars", United States dollars, unless otherwise stated.

Unless otherwise stated, references to annual rates of growth or variation signify compound annual rates.

Individual figures and percentages in tables do not necessarily add up to corresponding totals, because of rounding.

UNITED NATIONS PUBLICATION

ISSN 0251-2920

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

Copyright © United Nations 1990
All rights reserved
Printed in Chile

CEPAL

Review

Santiago, Chile

Number 40

CONTENTS

Development, crisis and equity. <i>Oscar Altimir.</i>	7
Macroeconomic policies: in search of a synthesis. <i>Daniel Schydłowski.</i>	29
An industrial and technological strategy for Brazil. <i>Joao Paulo dos Reis Velloso.</i>	37
Social structures and democracy in the 1990s. <i>Marshall Wolfe.</i>	53
The growing presence of women in development. <i>Miriam Krawczyk.</i>	69
Unequal participation by women in the working world. <i>Irma Arriagada.</i>	83
From agrarian reform to associative enterprises. <i>Emiliano Ortega.</i>	99
The capital goods industry: situation and challenges. <i>Jorge Beckel.</i>	117
Population and development in the Central American isthmus. <i>Andras Uthoff.</i>	133
Development and social change in Sweden. <i>Villy Bergstrom.</i>	153
Guidelines for contributors to <i>CEPAL Review.</i>	161
Some recent ECLAC publications.	163

The capital goods industry: situation and challenges

*Jorge Beckel**

This article attempts to provide an overview of the situation of the production and supply of capital goods in Latin America, the trends over the last few years and the challenges facing the reactivation, restructuring and expansion of this industry during the 1990s. The capital goods industry has often been considered, in the theory and practice of development, as a strategic industry, owing to its links with the other productive sectors and its function in the process of technological innovation. Because of the crisis affecting the economies of Latin America, which has been expressed in violent inflationary processes, in a marked decline of investment in most of the region, and in a contraction of the demand for capital goods, the industry that produces these goods faces serious difficulties and in some countries its very survival is threatened. There are also structural and long-term obstacles to development of an industrial activity which is intrinsically complex because of its markedly technological character, which makes it necessary to conceive of development with a long-range view. This article is based on the results of a regional co-operation project which ECLAC carried out together with UNIDO under the auspices of UNDP.

*Official of the ECLAC/UNIDO Joint Division of Industry and Technology of ECLAC.

Introduction

The manufacture of capital goods in Latin America and the Caribbean has advanced greatly in the last 40 years. The following accomplishments bear witness to this fact: hydraulic turbines that are among the largest in the world, complete industrial plants for the industries of steel, cement, pulp and paper, numerically controlled machine-tools and heavy transport equipment. The small countries of the region have also begun to manufacture capital goods of a certain complexity, such as hydrogenerator components, installations for the petroleum industry and spare parts for mining equipment.

On the one hand, this progress occurred spontaneously, the outcome of the industrialization process that took place in the region during the period under examination here. But capital goods production has also been shaped by the economic and development policies of the Latin American countries. These policies did not always consider the development of a local production of capital goods as part of their objectives; indeed, at times they favoured their importation. On the other hand, in certain countries and at certain moments, the authorities promoted the development of capital goods production, recognizing the strategic function that the industry plays and considering that the development attained was insufficient or below what was desired.

At the present time, the situation of the capital goods industry in the region is very much influenced by the acute crisis that affected Latin America and the Caribbean during the 1980s. The characteristic phenomenon of that period was the massive transfer abroad of financial resources and a sharp decline in investments, which fell by an average of 20% between 1980 and 1989.¹ Most of the countries experienced virulent inflationary processes, stagnation or recession, as well as high fiscal deficits. This evolution seriously affected the capital goods industry, leading to high indexes of idle capacity

¹See ECLAC (1989b). Machinery and equipment declined an average of some 25% for a group of 15 Latin American countries between 1980 and 1988.

in the productive plants, serious financial problems in the enterprises and some attempts at industrial restructuring.

The recovery of the capital goods industry depends basically on the Latin American countries being able to re-establish their conditions of economic growth. This would mean, among other things, boosting the level of productive investment—the factor that determines domestic demand for these goods—and therefore also sustained economic growth. Apart from this general or macroeconomic question, the countries must undertake certain specific tasks for the restructuring, consolidation and development of the capital goods industry. These include the modernizing of the productive apparatus, the broadening of the productive base in part of the region, and the strengthening of the negotiating capacity of local enterprises.

In the developed world, the capital goods industry went through an intensive process of modernization and restructuring during the 1980s.² Latin American industry, on the contrary, did not, in general, participate in this trend. Resources for investment were lacking, and the sombre economic perspectives caused the suspension of many industrial projects. Consequently, part of the productive apparatus in the region faces the danger of soon becoming technologically obsolete. The fact that the region's labour and engineering costs are lower than those in the developed world compensates only partially for the erosion of its international competitiveness, and does not constitute a permanent advantage. In the capital goods industry, modernization and restructuring on a world level are derived to a large extent from the application of a generation of new technologies, based especially on micro-electronics and informatics. Typical examples are computerized numerically-controlled machine-tools and the use of microprocessors and microsensors in the automatic control of manufacturing processes. Technological innovation, which also includes the management of production and product and project engineering, frequently consists of using computers—among the different kinds, the personal

computer, the microcomputer and informatic networks. Notable among the new technologies are new materials, which often determine innovations in manufacturing processes, apart from changing the characteristics of products. Moreover, technological innovation is accompanied by conceptual changes in the organization of enterprises.

Besides being modernized, the capital goods industry is being restructured on a continental scale. The avalanche of mergers and acquisitions of enterprises and co-operation agreements that is taking place in the developed world is rooted in the very nature of technological innovation and entails a profound change in the world demand for capital goods and the conditions for their marketing. In this way, industrial modernization aims to reduce manufacturing costs, shorten production time, guarantee better quality, respond more rapidly to customers' requirements, and face fluctuating market needs with greater flexibility.

All these trends have greatly increased international competitiveness in domestic and export markets. In the Latin American countries, modernization of the capital goods industry is not only a question of financial resources, but also a challenge to obtain the appropriate technology. The distance of part of the region from the world centres of technological innovation, the insufficiency of local technological capacities and the slow dissemination of the new technologies in Latin America, are some of the obstacles that must be overcome.

Another regional problem in the field of capital goods is the potential for broadening the productive base in the medium-sized and small countries during the 1990s. The productive base for capital goods is at present rather narrow in this group of countries.

A series of countries has idle capacity at the moment. However, as the example of Chile demonstrates, when the economy is reactivated, the situation can change rapidly, i.e., from a situation of inactivity to one of making full use of that capacity.³ Moreover, in the group of coun-

²See, for example, the Economic Commission for Europe (1988); Edquist and Jacobsson (1988), and the Commission of the European Communities (1985).

³In Chile, the production capacity for elements for boilers increased from 38 000 tons a year to 75 000 tons a year in recent years, as a result of a reactivation of demand and change in the contract policies of State enterprises.

tries under consideration, supply is somewhat diversified and, in particular, there is an insufficient production of machinery, or capital goods of a certain level of complexity and specialization. The requisites for achieving these goals are above all the introduction of stable and clear rules for the development of the sector. These should provide reasonable protection for national industry and lines of financing for selling locally-produced capital goods in domestic and external markets, along with a series of other collateral measures. Moreover, the enterprises and industrialists of the medium-sized and small countries need help in acquiring the experience that the capital goods industry in the neighbouring countries have. These needs must be rapidly satisfied by a number of practical actions. For example, possibilities would have to be created for technicians and specialized workers of the medium-sized and small countries to be trained in the factories of the more advanced countries of the region. Industry representatives from the medium-sized and small countries have repeatedly made these needs clear.⁴ Probably, as a next step, the industry of the more advanced countries would become sensitive to these demands, by opening their doors and announcing their availability for training. Governments could complement the private sector's initiatives by sponsoring and supporting the programmes and other measures.

Finally, the fact that only a very small proportion of the external supply of capital goods for the countries of the region is of regional origin invites reflection. The medium-sized and small countries represent approximately half the regional imports of capital goods and, consequently, they are very important as buyers in the regional context. Would it not be possible and desirable for everyone to combine to some degree the local capacities of these countries with those existing in the more advanced countries of the region, with the express object of increasing local participation in the supply of machinery and equipment? Would it be realistic to think that the medium-sized and small countries negotiate access to their markets in

exchange for training facilities, for example? Finally, would it be feasible to establish tripartite associations between local, regional and producers from developed countries, in which the developed countries would provide technologically advanced goods and services and a quota of additional financing? A task related to this point faced by the countries in the 1990s consists in strengthening the negotiating capacity of local enterprises.

It was mentioned above that government policies were formulated in part of the region to promote the production of capital goods. The necessary mechanisms for analysis and promotion were created for this objective. However, until recently, the different national views of sectoral development were elaborated in complete isolation. The governments of the Latin American countries took steps to overcome this situation when they approved a project of regional co-operation, which ECLAC carried out with UNIDO in the 1980s, under the auspices of UNDP. As a result of this work, there is now a coherent view of the situation of supply and the production of capital goods in the region.

This article, based largely on the results of the ECLAC/UNIDO/UNDP regional project, is composed of two sections.

In the first, some characteristics of the supply and demand of capital goods are presented for the countries of the region as a whole. An important question is the size of the domestic market in the different Latin American countries and in the region as a whole. This is relevant if we consider that the production of capital goods is developed in a country, at least in a first phase, on the basis of supplying the domestic market. If the possibility of bringing the countries together in a regional context is included, for example, by negotiation with extraregional agents, the question about the size of the regional market becomes also relevant. Another consideration is the sectoral structure of the demand for capital goods. This information shows the user sectors where demand is concentrated in a few projects, and those where it is widespread.

Thirdly, estimates are presented concerning the degree in which the different Latin American countries supply themselves with capital goods or, on the contrary, the degree to which

⁴See, for example, the remarks of the industry representatives from Argentina, Colombia, Costa Rica and Venezuela in ECLAC (1989c).

they depend on imports. This provides the answer to the question about the impact of trade in capital goods on the countries' balance of payments. Finally, this section attempts to measure the progress needed by the Latin American countries in the production of capital goods in terms of an international comparison.

The second section highlights a particular problem of the development of the capital goods industry in the region, namely the production, in the small and medium-sized countries, of equip-

ment for the basic industries. For this purpose, the results of research on current manufacturing capacity are presented. Next, some estimates are given in order to illustrate the participation that could be attained by locally supplying machinery and equipment to investment projects in the different basic sectors. Two options were considered for this purpose: local manufacturers either proceed independently or alone, or act in association with producers from the more advanced countries of the region.

I

Main characteristics of the supply and demand of capital goods in the region

This description of the supply and demand of capital goods refers in general to the group of Latin American countries that form part of the Latin American Integration Association (LAIA) and the Central American Common Market (CACM). In some cases, Panama and the Dominican Republic are included. For the other countries of the region, it is not only more difficult to obtain data comparable to those of the first groups considered, but also their problems of supply and production of capital goods are different. The reasons for this are to be found in the size of their market and in other specific circumstances.

At the end of the 1980s, Latin America and the Caribbean represented a demand for capital goods which, as an investment value in machinery and equipment, can be estimated at US\$70 billion a year. This figure is below the level that demand for capital goods reached at the beginning of the decade. In spite of this contraction, the region still represents at the present time a considerable part of the world demand for machinery and equipment. If specific products are considered, the weight of the region as a whole is very important. For example, hydroelectric works programmed for the period 1980-2000 show that regional needs amount to an estimated 1 913 units of hydrogenerator groups,

with an average potential of 142 mW.⁵ Although the demand for this equipment has contracted greatly in recent years, these projections at least show the needs that the region would have in normal conditions of economic growth. It was estimated that, in a normal situation, Latin America represented approximately a third of the western world's demand for this kind of equipment.

Returning to the consideration of the size of the markets —if capital goods are taken as a whole and compared historically, it can be observed also that the demand for capital goods in the different countries is sufficiently large to support the development of a rather significant local production. Thus, Brazil represented before the financial crisis, in 1980, a domestic demand similar in size to that of the German Federal Republic in 1965, while the markets of Chile, Peru or Colombia were similar in size to some small countries in northern or central Europe. Finally, the region as a whole formed a market as big as that of the United States 25 years before.

Latin America presents a sectoral structure of its demands for capital goods that reflects its particular economic physiognomy and invest-

⁵ECLAC (1983).

ment needs. The outstanding sectors are those of the economic infrastructure, especially electric energy, those that extract preliminary products, particularly petroleum, mining and agriculture, and the basic or primary processing industries. These sectors represented in the 1970s approximately 40% of the total demand for capital goods in the region.⁶ The participation of these sectors is probably somewhat less at this time, as one of the consequences of the financial crisis affecting the region. Since most of these sectors are the main users of heavy equipment made on demand, the crisis would have affected more severely the local producers of this kind of capital equipment.

In global terms, the regional demand for capital goods was at the end of the 1980s some 25% below the highest level reached in 1980. The differences between the distinct countries are notable.⁷ While demand in Brazil declined by the regional average, that of Argentina has been cut almost in half. Another group of countries, including Colombia, Costa Rica, Chile and Paraguay, have recovered their previous level or are about to do so.

The degree of supply is expressed as the share that national production for the domestic market has in the value of the domestic demand for capital goods. The value of national production is difficult to estimate over a series of years, except in a few cases in which the national accounts indicate in what proportion investment in machinery and equipment is of national origin or imported. In the other cases, it generally depends on the information obtained from the industrial censuses that the countries of the region normally carry out every 10 years. For this reason, the figures mentioned below go back to 1980. At that time, Brazil would have supplied 74% of its own needs; Argentina, Mexico and Peru would have reached a degree of national supply that varied according to the country between 59% and 60%; while in most of the other 15 Latin American countries, this relation fluctuated between 17% and 35%. According to

these estimates, Latin American supply was 57% of national origin as opposed to 43% imported. There is no indication that the drop in demand for capital goods that took place during the 1980s originated in substituting national production for imports or vice versa.

In the conditions under which the Latin American economies operate, particularly at the present time, the question of the impact of imports or trade in capital goods on the balance of payments is very pertinent. These amounts can be compared with total exports of goods for that purpose. There are two extremes in the situation of the different countries: Brazil, which has increased its capital goods exports considerably, to the point where it has almost completely compensated for its imports of those goods, and the other Latin American countries, whose exports do not compensate for their imports. In Brazil, the trade balance for capital goods represented in 1975 half of the income from their total exports of goods, and in 1987 only 1%. Naturally, this result was obtained both because of the increase in their exports as well as because of their lower imports of capital goods. In the other Latin American countries, uncompensated capital goods imports strongly influenced the balance of payments in the period prior to the financial crisis. Considering the group of countries in the Latin American Integration Association and the Latin American Common Market, but without Brazil, the commercial balances of capital goods represented approximately half of the value of the total exports of goods between 1975 and 1981. In 1987, that proportion had dropped to 19% as a result of the increase in total exports of goods, the decrease in capital goods imports and, to some degree, also because of the increase in capital goods exports in the case of Mexico.

The value added of the production of capital goods can give an idea of the importance and the level of development reached by this industry in the different countries of the region. The information is derived basically from industrial censuses, and in the case of the Andean countries, from the research carried out by the Board of the Cartagena Agreement.⁸ The results of the estimates made on the basis of these data generally

⁶This figure is derived from research carried out by the Joint ECLAC/UNIDO Industry and Technology Division for the 1970s. See Jorge Beckel and Salvador Lhuch (1982).

⁷This is indicated by the statistical series on investments in machinery and equipment elaborated by ECLAC's Statistics and Projections Division. See ECLAC (1989a).

⁸See JUNAC (1985).

refer to 1980. In terms of value added, the figures for the production of capital goods were the following: Brazil, US\$12 billion; Argentina and Mexico, between US\$2 billion and US\$3 billion; Colombia, Chile, Peru and Venezuela, production levels between US\$250 and US\$550 million; and Bolivia, Costa Rica, Ecuador and Uruguay with production figures between US\$15 million and US\$100 million. As can be observed, there is a marked variation in value added in the capital goods industries of the different countries. Brazil represents 60% of the value of the total production of the region, and Argentina and Mexico together, a quarter. Brazil's production is 25 to 50 times greater than that of a country with an intermediate-sized market. Even though production figures for recent years are unavailable, from the decline which has occurred in the levels of investment in the region, it can be inferred that the production of capital goods would have contracted in the majority of the countries. Moreover, the recession in investment in machinery and equipment affected unequally the different production sectors of capital goods. Finally, export possibilities have not been the same for all the productive sectors of all the countries.

With this data on the level of development that the capital goods industry has reached in the region, an international comparison can be ventured.⁹ For this purpose, somewhat broader groups of capital goods must be used, in other words, the metal manufactures and machinery industry defined as group 38 of the Standard International Industrial Classification or, in the case of external trade, to machinery or transport equipment, as section 7 of the Standard International Trade Classification. In both cases, capital goods represent from country to country a variable but always substantial proportion of the respective value of production or trade of the statistical category considered. Table 1, which shows some of the characteristics of the development of the capital goods industry in 1980, includes a group of 35 countries: Latin American countries, developed countries with a market economy and developing countries in Asia. In

the first column is the share of the metal manufactures and machinery industry in the total value added of manufacturing. The three remaining columns show some characteristics of the external trade of machinery and transport equipment. These columns represent the share of machinery and transport equipment in total imports and exports of goods and, finally, the relation between specific exports and imports. By observing the figures in the first column, it can be concluded that Argentina and Brazil have an industrial structure similar to those of some developed countries with market economies and somewhat superior to that of the Republic of Korea, as an example of a newly industrialized Asian country. The other Latin American countries are generally quite below this pattern, with the exception of Mexico, which occupies an intermediate position. By referring to column B of the table, which shows the weight of capital goods in the total imports of goods, it can be noted that the Latin American countries are generally similar to the other countries considered, with the sole exception of Japan. The situation changes when observing the percentages of column C, which indicate the weight of capital goods exports in the total exports of goods. In comparison with the developed countries, the Latin American countries do not stand out in this sense. The only exceptions are Brazil on the Latin American side, and Australia and New Zealand on the side of the developed countries. With regard to the Asian countries, Korea and Singapore are like the developed countries, and the rest like the Latin American countries. Finally, it is interesting to examine what relation there is between exports and imports of capital goods. It shows here that the Latin American countries generally compensate for a very small part of their imports of capital goods with exports of these same goods, while the opposite occurs among the developed countries. The situation of the developing countries of Asia is heterogeneous and agrees with what was pointed out above.

This analysis clearly indicates that in Latin America, with the exception of Brazil and possibly of Argentina and Mexico, the capital goods industry is lagging behind manufacturing production in general, and shows, moreover, a weak involvement in the world market.

⁹This observation is made in one of the reports of the ECLAC/UNIDO/UNDP project "La situación actual y las perspectivas del abastecimiento y la producción de bienes de capital en América Latina" (RLA/77/015). See ECLAC (1984b).

Table 1

**INDICATORS OF THE METAL MANUFACTURES AND MACHINERY
INDUSTRY IN DIFFERENT REGIONS OF THE WORLD, 1980**

(Percentages)

Countries	A	B	C	D
<i>Latin America</i>				
Argentina	28.5	25.1	7.5	0.35
Bolivia	4.9	42.8	-	-
Brazil	34.8	23.3	18.2	0.58
Colombia	14.1	39.4	3.5	0.04
Costa Rica	9.9	30.7	3.6	0.08
Chile	15.0	28.1	1.3	0.04
Ecuador	12.2	53.3	1.2	0.02
El Salvador	7.4	24.2	2.0	0.08
Mexico	22.8	36.5	4.5	0.10
Paraguay	16.6	67.6	-	-
Peru	14.6	30.3	1.8	0.06
Dominican Republic	7.1	22.2	0.7	0.01
Uruguay	16.7	48.2	5.0	0.12
Venezuela	15.4	29.7	0.3	0.01
<i>Developed countries with market economies</i>				
Australia	31.0	36.1	7.1	0.22
Belgium	33.1	22.5	21.6	0.86
Canada	32.1	46.0	26.1	0.62
Spain	29.3	17.9	26.3	0.90
United States	43.9	25.0	40.2	1.39
Finland	26.6	26.6	17.7	0.60
France	38.6	21.3	33.7	1.30
Italy	36.4	20.2	32.5	1.26
Japan	41.2	6.0	58.4	9.04
Norway	35.1	28.5	12.2	0.47
New Zealand	25.0	27.7	4.3	0.14
Netherlands	32.6	19.7	16.2	0.81
United Kingdom	40.4	25.8	34.7	1.30
Federal Republic of Germany	43.9	18.7	44.9	2.47
Sweden	42.8	26.8	39.7	1.37
<i>Developing countries in Asia</i>				
Republic of Korea	24.2	22.5	20.3	0.71
Philippines	14.1	27.4	1.8	0.05
Hong Kong area	28.0	18.5	7.5	0.33
Indonesia	15.1	33.5	0.5	0.03
Singapore	51.6	29.4	26.4	0.72
Turkey	20.7	28.1	1.9	0.03

Source: United Nations, *Yearbook of Industrial Statistics*, 1980 Edition, vol. 1, *General Industrial Statistics* (ST/ESA/STAT/SER.P/19 (vol. 1), New York, 1982. 1981, *Statistical Yearbook 1979/1980*, 31st Edition (ST/STAT/SER.G/29), New York, 1981, *Yearbook of International Trade Statistics*, 1980, vol. 1, *Trade by Country* (ST/ESA/STAT/SER.G/29), New York.

Note: Column A: participation of the metal manufactures and machinery industry (group 38 of the SIC classification, Rev. 2) in the value added in manufacturing.

Column B: Participation of machinery and transport material (section 7 of the SIC) in total imports of goods.

Column C: Participation of machinery and transport material in the total exports of goods.

Column D: Coefficient between exports and imports of machinery and transport material.

II

The potential of local production of equipment for the basic industries in the medium-sized and small countries

1. *The production capacity for equipment made on demand*

We have seen that there is a marked variation in the production levels of the different countries of the region. In particular, the production volumes of the three countries with the largest markets, especially Brazil, far surpass those of the other countries. However, the capacity to produce capital goods in a country is expressed not only by the maximum value of the production that can be delivered in a given period; it also concerns the type of products which can be manufactured, the sizes and other technical specifications that can be offered and the manufacturing processes that are applied. In this regard, Argentina, Brazil and Mexico also show a great diversification in their supply, which is reflected, as we have seen, in the degree of supply which the local capital goods industry reaches in the domestic market of each of the countries. The participation of metal manufactures and machinery in the manufactured products is already comparable in the case of Brazil, and to a lesser extent Argentina and Mexico, to that of a typical developed country. Finally, Brazil and Argentina, and more recently, Mexico, generate exports of capital goods in appreciable amounts, which indicates their capacity of insertion into the world market.

On the other hand, the manufacture of capital goods in the medium-sized countries is relatively more out of date, and the same observation applies in general to the capital goods industry of the countries with relatively smaller markets with respect to the countries of the second group. It can be inferred from this that the development potential of the production of capital goods in the region is, always in comparative terms, greater at this time in the medium-sized and small countries. Second, the fact that the countries of the region have different levels of industrial development suggests that industrial

co-operation between productive enterprises of the countries with a different technological level could facilitate the upgrading of the production capacity in the countries of relatively less industrial development. From a regional perspective, therefore, it would be especially interesting to know what is the production capacity of the medium-sized and small countries.

Before considering this question, another observation should be made. Capital goods are usually classified in two large categories: those made on demand and those produced serially. The former are mostly for investment projects in infrastructure and basic industries. The enterprises of these sectors are usually large economic units, which often also have a certain capacity for project engineering. This can be an important factor for the development of technological capacities in the local capital goods industry. Moreover, investment projects, to the extent that they reach a certain size, require the participation of several suppliers or manufacturers, and therefore allow for or justify putting together operations of industrial co-operation on a regional or international scale. For these reasons, the information and observations presented below refer basically to goods made on demand.

Some general observations can be made about the installed capacity of the medium-sized and small countries. First, it can be noted that technologies proper to metallic structures and boiler products are more widespread than mechanical and electromechanical technologies, at least with respect to the manufacture of heavy equipment. The supply of mechanical products for heavy equipment is mostly spare parts. However, there are also some important investments for the construction of heavy machinery, but these are intermittent. Second, some technical missions carried out at the beginning of the 1980s reported that in most of the countries visited, production equipment was usually quite

old.¹⁰ Because of the difficult economic situation of the Latin American countries in recent years, the situation cannot be expected to have changed much.

Third, the production capacity of large extractive and basic industries, railroads, naval shipyards and workshops of the other branches of the armed services is usually very large. These capacities normally do not compete in the market with manufacturers of capital goods, but rather respond to the needs of their own enterprise or institution, in competition with independent manufacturers or not. Lastly, the supply representative of the production capacity influences the particular economic structure of the countries. Thus, Chile, Peru and Bolivia stand out for their manufacture of mining and metal-working equipment, while the supply of the Central American countries and the Dominican Republic typically consists of equipment for the sugar industry and agricultural activity.

The production capacity of the medium-sized and small countries in some categories of capital goods made on demand is analysed below. Consideration was given to metallic structures, storage tanks and processing equipment, steam boilers, cranes, mining and metallurgical equipment, railway equipment and electric transformers. The information refers mostly to the predominant situation in the countries in the early 1980s, which could now be changed in some cases.

As mentioned above, the medium-sized and small countries are most developed in boiler-making. The most typical of the different products are storage tanks, processing equipment, heat exchangers and heavy metallic structures. Supply also includes welded structural components for a variety of equipment. Examples of this equipment are cranes, mining and metallurgical machinery and railroad cars. Manufacturing technology consists of cutting and shaping sheet metal and steel sections, welding elements together and relieving stress by heat treatment. A good way to assess the technical production capacity of a country in this kind of product is to observe the characteristics of the main operating

machines, cranes and furnaces for relieving stress. Table 2 shows the current situation in the Andean countries, including Chile and Central America and the Dominican Republic. Among the medium-sized countries, Venezuela stands out for its production capacity, as does Paraguay among the small countries. Table 3 shows the production capacity of the different countries, by the quantities of the different products that can be manufactured. The estimates presupposed an adequate use of productive installations, according to the technical structure of each establishment.

Steam boilers are of the watertube type in the high-powered category. Among the countries considered, Colombia has the most experience in the design and manufacture of these products. Units of natural circulation with a power of up to 900 metric tons of steam per hour were already being manufactured in the early 1980s. There was a high degree of national integration. Besides special-alloy tubes, only part of the domes and some accessories were imported. Peru, Uruguay and Venezuela also produce watertube boilers, but with less power. Cranes are made in most of the medium-sized and small countries. In reality, the structure is made there; the mechanical, electromechanical and electronic components are mostly imported. The models made are usually erector's derricks; rarely are they heavy-duty equipment like those used in the steel or metallurgical industries. The crane with most lifting capacity—750 metric tons—was made in Venezuela for the hydroelectric plant in Guri. Cranes of up to 200 metric tons of lifting capacity have been made in the other medium-sized countries. The small countries have made cranes with up to 40 metric tons of lifting capacity.

Chile and Peru have about the same technical capacity in mining and metallurgical equipment. They have made more progress in equipment for mineral-concentrating plants than in equipment for mining and metallurgy. The appendix at the end of this article gives an idea of the range of equipment manufactured in these countries. National integration is partial with respect to the first four items of mining equipment on the list. Most of the mechanical components, such as transmissions, gear-boxes, internal-combustion motors and hydraulic

¹⁰ See, for example, ECLAC (1984a).

Table 2

**LATIN AMERICA: INDICATORS OF THE CAPACITY OF BOILER-MAKER
ESTABLISHMENTS IN MEDIUM-SIZED AND SMALL COUNTRIES**

Country	Max. thickness of sheetmetal with cold cylinders ^a	Max. diameter and thickness of bottom and heads	Lifting capacity of cranes	Stress relief furnace
Bolivia	19 mm (3/4 in.)	2.5 m x 5/8 in.	10 ton	-
Colombia	60 mm (2 3/8 in.)	4.5 m x 1 1/2 in.	120 ton	5.6 x 5.6 x 23.0 m
Chile	50 mm (2 in.)	4.0 m x 7/8 in.	55 ton	4.0 x 5.0 x 20.0 m
Ecuador	45 mm (1 3/4 in.)	3.0 m x 1 1/2 in.	30 ton	-
Paraguay	75 mm (3 in.)	...	60 ton	6.0 x 4.0 x 10.0 m (950°C)
Peru	80 mm (3 1/8 in.)	4.0 m x 1 1/2 in.	60 ton	6.0 x 5.0 x 8.5 m
Uruguay	19 mm (3/4 in.)	...	20 ton	2.5 x 2.5 x 10.5 m
Venezuela	75 mm (3 in.)	5.0 m x 1 1/2 in.	200 ton	6.5 x 6.5 x 18.0 m (959°C)
Central America (Guatemala)	19 mm (3/4 in.)	2.5 m x 5/8 in.	10 ton	-
Dominican Republic	32 mm (1 1/4 in.)	...	30 ton	3.0 x 2.5 x 10.0 m

Source: ECLAC, *Notas sobre la capacidad de producción de bienes de capital en algunos países latinoamericanos* (E/ECLAC/L.296/Rev.1), Santiago, Chile, 1984.

^aSheets 3.0 m wide, except in the cases of Paraguay and Venezuela, where the figures are for sheets 4.0 m wide.
... indicates a lack of information.

Table 3

**LATIN AMERICA: ESTIMATED PRODUCTION CAPACITY OF BOILER ELEMENTS
AND STRUCTURES IN MEDIUM-SIZED AND SMALL COUNTRIES**

(Metric tons per year)

Country	Metallic structures	Storage tanks	Pressure vessels and columns	Heat exchangers	Total
Bolivia	2 000	1 000	500	-	3 500
Colombia	15 000	15 000	8 000	3 000	41 000
Chile	18 000	15 000 ^a	3 000	1 000	37 000 ^b
Ecuador	6 000	8 000	2 500	500	17 000
Paraguay	...	...	...	...	...
Peru	12 000	10 000	4 000	2 000	28 000
Uruguay	...	...	...	...	...
Venezuela	65 000	35 000	20 000	10 000	130 000
Central America	4 000	2 000	500	-	6 500
Dominican Republic	4 200	1 500	800	200	6 700

Source: ECLAC, *Notas sobre la capacidad de producción de bienes de capital en algunos países latinoamericanos* (E/ECLAC/L.296/Rev.1), Santiago, Chile, 1984.

^aIncludes current capacity of the steel mill of CAP (5 000 metric tons a year).

^bThe production capacity of Chile is at present above 75 000 metric tons a year, owing to the reactivation of some boiler-making plants and the creation of new industrial capacity.

... indicates a lack of information.

controls are imported. The mining and metallurgical equipment listed is manufactured partly under licence and partly from local designs. Bolivia also manufactures some mining and metallurgical equipment, but of lesser dimensions. Colombia and Venezuela have recently developed large mining and metallurgical projects. This has also given an impetus to the production of some specialized equipment and components in both countries.

The metal manufactures and machinery industries of Colombia, Chile and Peru are quite experienced in the manufacture of railroad freight cars and their components. The railroads and mining enterprises provide most of the demand for this equipment. Supply includes special cars for transporting minerals and concentrates, equipped for unloading from the side or rear. Chile, for example, has manufactured cars with capacity for 100 metric tons. The three countries have begun to manufacture passenger cars, but on a lesser scale. The quantities of freight cars supplied in recent years have been quite large in some of the countries mentioned: all of them manufacture a rather extensive range of components; some have even exported on a large scale to the countries of the region. In spite of these favourable developments, the manufacture of moving railway equipment has not given rise to a specialized industry in Colombia, Chile or Peru, owing to a lack of continuity of demand and contraction in the sectors of demand. Proposals have been made occasionally to remedy this situation by programming the acquisitions of the State railroads. However, these proposals have only been put into practice sporadically.

Transformers are one of the products most representative of electrical equipment. A distinction is usually made between power-load and distribution transformers. The former are larger units and are designed and manufactured on demand, while the latter are typically products made in series. The manufacture of power transformers is well established in Colombia, Chile, Peru and Venezuela. The larger units made in those countries have a running voltage of up to 166 kV and a power potential of up to 50 mVA. The manufacturers are both locally-owned enterprises and subsidiaries of well-known international firms.

2. The possibilities of local integration according to different strategic perspectives

A series of studies was carried out in the framework of the ECLAC/UNIDO/UNDP regional project to estimate the participation that the capital goods industry in the medium-sized and small countries could attain in the investment projects of some basic sectors.¹¹ Among these sectors and projects, particular consideration was given to electric energy generating plants, mineral-concentrating plants, cement factories, and pulp plants. With this objective, production units were considered that were representative, because of their scales and technological characteristics, of the known investment projects in the group of countries mentioned. The analysis included an identification of the main machinery, equipment and metallic structures used in the investment projects. Data were normally obtained on the more important technical characteristics and the weight and value of the distinct units. The knowledge of production capacity, acquired previously through research in some countries of the region, made it possible to estimate, on the basis of the weight and value of the machinery and equipment, the share of the supply that the local capital goods industry could attain. Two hypotheses were formulated for this purpose. One was that the local industry would undertake, basically without outside help, the manufacture of the equipment needed. In other words, it would operate exclusively with its own productive resources and technical experience. The second hypothesis supposed industrial co-operation among local producers and plants of the more advanced countries of the region. The presumption was that, through industrial co-operation agreements, the industries of medium-sized and small countries would basically have access to the manufacturing know-how of the more advanced partners.

A few observations are made below regarding the kinds of machinery and equipment that could be manufactured by local industry in the different countries, with respect to each one of the basic sectors and types of projects considered. Table 4 presents the coefficients of local integration that were estimated for the different cases.

a) *Hydroelectric plants*

It would be possible in the medium-sized countries to manufacture certain components for the turbines of the Francis and Kaplan type, such as the spiral casings and the ventilation shafts. To do so, the local enterprises would need technical support from enterprises specialized in the manufacture of this equipment. Given the experience of the region, this support could be given by certain factories in the large countries. For hydrogenerators, the possibilities for local integration would be less and would basically consist of the manufacture of some elements such as idling rings. On the contrary, most of the pressure tubes, sluices (with some limitations with respect to their mechanisms and drives), gates, gantry-crane structures, and the different metallic structures needed in hydroelectric plants could be manufactured in both the medium-sized and the small countries.

b) *Thermoelectric plants*

In Colombia there is a specialized enterprise that can provide the kinds of boilers required by public-service thermal power stations of the self-generating type constructed in the medium-sized and small countries. The other medium-sized and small countries have less technological capacity in this category. However, they can also make some of the components that go into a steam watertube boiler and the metallic structures required for the installation of a thermoelectric plant. In the medium-sized countries, these elements would be basically the water walls and economizers of the boiler, the air pre-heater, the vapour condenser, the deaerators, the casing and structure of the electrostatic precipitator, the ventilator casings, the metal casing of the chimney, the low-pressure steam piping, as well as the foundations of the boiler and the main building. In the small countries, the possibilities of local manufacture would include a more limited range of such elements.

c) *Mineral-grinding and smelting plants*

The medium-sized countries can manufacture most of the jaw crushers, cone grinders, ball and bar crushers up to 1 000 hp, feeders, classifiers, vibrating sieves, cyclones, flotation cells, thickeners, filters and driers. Manufacturing

possibilities would be more restricted for complex mechanical components.

In the small countries, the possibilities of local manufacture would be somewhat more reduced.

d) *Sugar mills*

In the medium-sized countries, and to some extent also in the small countries, parts of steam generators, exchanges, evaporators, vacuum receptors, conveyers, tanks and piping can be manufactured.

e) *Pulp plants*

In the case of the pulp industry, the possibilities of local supply were considered in relation to chemical and thermomechanical processes. The equipment used in each case is quite different.

In the small countries there are possibilities of local manufacture of essentially different boiler products and metallic structures. In the medium-sized countries, the manufacture of a large part of the mechano-electronic equipment could also be considered. However, there are limits to the production of heavy machinery and self-propelled loading equipment.

f) *Cement plants*

A rather extensive range of equipment for cement plants can be manufactured in the medium-sized countries. This is particularly true for parts of the tube of the rotary furnace, as well as for the conveyer belts and gantry cranes, except the more complex electromechanical drives for this equipment. Finally, the local industries of these countries can supply the grinding parts of the mills and a series of light mechanical and electromechanical equipment.

The small countries could also make some components of the rotary furnace and the metallic tanks and silos, metallic piping and structures, as well as some structural components of the conveyer belts.

g) *Summary*

Table 4 presents a summary of the estimates of the degree of local integration that could be attained in different investment sectors and conditions of co-operation. The estimates made cor-

Table 4

POSSIBLE PARTICIPATION OF THE INDUSTRY OF MEDIUM-SIZED AND SMALL COUNTRIES IN THE SUPPLY OF MACHINERY AND EQUIPMENT OF DIFFERENT INDUSTRIAL AND ENERGY PLANTS IN DIFFERENT CONDITIONS OF CO-OPERATION

(Percentages of participation on the basis of the value of the equipment)

Type of plant	Size of plant	Medium-sized countries		Small countries	
		Alone ^a	Co-operation ^b	Alone	Co-operation
— Hydroelectric	300 MW	30	34	8	15
— Thermoelectric	150 MW	55	55	15	20
— Concentration of minerals					
— large plant	40 000 ton/day	43	...	...	...
— small plant	1 700 ton/day	57	...	...	...
— Sugar mill		60	...	...	...
— Pulp					
— chemical	500 ton/day	17	38	13	15
— thermomechanical	300 ton/day	18	27	10	16
— Cement	1 700 ton/day	45	...	20	...

Source: ECLAC/UNIDO/UNDP project, "La situación actual y las perspectivas del abastecimiento y de producción de bienes de capital en América Latina" (RIA/77/015).

^aCorresponds to the degree of integration that local industry can attain if it acts independently.

^bCorresponds to the degree of integration that local industry can attain if it has the technical support of the industry of the larger countries of the region.

... Means it was not evaluated.

respond to the value of the equipment. As can be observed, local industry can attain considerable rates of participation in all cases, especially in those which are representative of the medium-sized countries with regional industrial co-operation. Up till now, the facts have been different. Numerous investment projects were carried out with a minimum of local participation, often limited merely to assembly services. In this way, the countries have not been able to

take advantage of the opportunities presented to them to advance the technological and industrial development of capital goods. Few new plants are being constructed at this time. Investments are basically oriented to the renovation and modernization of industrial installations and projects are normally smaller than before. These circumstances could favour orders to local and regional industry, and therefore could turn around the previous trend.

III

Conclusions

The initial considerations and the picture of industrial reality presented in this article make it possible to draw some conclusions about the perspectives for the production and supply of capital goods in Latin America. First, the domestic markets of most of the Latin American coun-

tries seem to be sufficiently large to increase the production of such goods. This affirmation would be supported by the results of the comparison of the industrial situations of the Latin American and the developed countries. The developed countries, however, are more

involved in the world economy, which would be one of the conditions for developing the production of capital goods in Latin America.

Second, the Brazilian capital goods industry has reached a high level of development. This is shown by the value of its production, its participation in supplying the domestic market and the amount of its exports. It may be inferred that there is no basic need to expand productive capacity there in the next few years. The national effort should be concentrated on modernizing and restructuring the productive apparatus, together with gradually opening the sector to international competition.

Third, a question is raised about the conditions and way in which production can be developed in the other Latin American countries, particularly the medium-sized and small ones. This question is naturally closely related to the economic systems that the countries adopt. At present, the trend in the region is towards increasingly open economies, a liberalization of external trade and the introduction of economic and fiscal reforms. This kind of system facilitates the access of enterprises to specialized technology and inputs, at the same time as it exposes them to more competition. If these systems become the rule in the region, they could lead to greater commercial exchange and more reciprocity between countries in the field of capital goods.

Fourth, the development of the capital goods industry should count on government support. This support would be especially important already in the phase of economic reforms and

trade liberalization for ensuring the survival of the sector. International experience shows that this support is efficacious, possibly because it is concentrated in some specific areas. These include, in particular, technological development, trade financing and capital formation. The policies of the developed countries and, in the regional context especially the experience of Brazil, provide examples of the ways in which the government can lend support.

Finally, it should be recognized that economic integration and industrial co-operation could fulfil an important function for the development of the production and supply of capital goods in the region. The progress recorded in recent years has been concentrated in two geographical areas: one which is comprised of Argentina, Brazil, Uruguay, and to some extent, also Paraguay; and the other formed by the countries of the Andean Group. Broader groups of countries should come closer together. Moreover, the objective would not have to be limited necessarily to supplying the regional market. Access to extraregional markets and an improved Latin American position for acquiring and using technology should be visualized, perhaps as a priority. The formation of large economic blocs in the world, like the European Common Market, the agreement between the United States and Canada and the growing economic co-operation between the countries of South-east Asia, which are large zones providing capital goods and technology to the region, constitute a new challenge to the initiatives to unite the Latin American countries.

Appendix

CHILE AND PERU: PRODUCTION OF MINING AND METALLURGICAL EQUIPMENT

I.

Mining equipment

Pneumatic drill platforms
LHD-type loaders, Diesel and electric motors
Jumbo drills (under development)
Motorized service vehicles
Plate feeders, Apron type and chain up to 84 inches wide.

II.

Mineral concentration plants

Hydrocyclones
Vibrating sieves up to 6 x 14 feet
Rotating sieves up to 8 feet in diameter
Rotating driers up to 12 feet in diameter
Thickeners
Spiral classifiers up to 78 inches in diameter

Flotation cells of the Denver and Galligher type up to 600 cubic feet
 Disc filters up to 10.5 feet in diameter
 Ball and bar crushers up to 13 feet in diameter
 Jaw crushers with simple and double effect up to 16 x 30 inches
 Roller grinders up to 24 x 24 inches
 Conical breakers up to 3 feet in diameter
 Hydraulic equipment to handling of casings.

III.

Metallurgical plants

Copper converter, Pierce-Smith type 13 feet in diameter by 30 feet long
 Refinery furnaces of 19 feet in diameter by 33 feet in length
 Casting wheels for copper
 Specialized equipment for electrolytic refineries
 Cast steel scoops for metal and slag with a capacity of up to 20 metric tons.

Bibliography

- Beckel J. and S. Lluch (1982), "Capital goods. Size of markets, sectoral structure and demand prospects in Latin America", *CEPAL Review*, No. 17 (E/CEPAL/G.1205), Santiago, Chile, August. United Nations publication, Sales No. E.82.II.G.3.
- Board of the Cartagena Agreement (1985), *La industria de bienes de capital en el Grupo Andino* (PABICA No. 1, J/DI/76), Lima, May.
- CEC (Commission of the European Communities) (1985), "Los bienes de equipos avanzados de producción en la Comunidad", *Boletín de las Comunidades Europeas*, Suplemento 6/85 (COM(85)112 Final), Brussels.
- Chudnovsky, D., M. Nagao and S. Jacobsson (1985), *Capital Goods Production in the Third World: An Economic Study of Technology Acquisition*, London, Frances Pinter.
- ECE (Economic Commission for Europe) (1988), *Engineering Industries: Dynamics of the Eighties* (ECE/ENG.AUT/35), New York. United Nations publication, Sales No. E.88.II.E.34.
- ECLAC (1983), *Demanda de equipos para generación, transmisión y transformación eléctrica en América Latina*, series Cuadernos de la CEPAL, No. 46 (E/CEPAL/G.1241), Santiago, Chile. United Nations publication, Sales No. S.83.II.G.9.
- (1984a), *Generación de energía eléctrica. Estudio de posibilidades de fabricación local de equipos* (E/CEPAL/G.1312), Santiago, Chile, 25 June.
- (1984b), *Notas sobre la capacidad de producción de bienes de capital en algunos países latinoamericanos* (E/CEPAL/L.296/Rev.1), Santiago, Chile, 27 February.
- (1989a), *Preliminary Overview of the Economy of Latin America and the Caribbean 1989* (LC/G.1586), Santiago, Chile, December.
- (1989b), *Cooperación técnica industrial: una perspectiva empresarial* (LC/R.821), Santiago, Chile, 21 November.
- (1989c), *La reestructuración mundial del sector de los bienes de capital y su proyección en el decenio de los años 1990: políticas industriales en los países desarrollados y en los países en desarrollo* (LC/L.479), Santiago, Chile, 7 March.
- (1990), *Statistical Yearbook for Latin America and the Caribbean* (LC/G.606-P), Santiago, Chile. United Nations publication, Sales No. E/S.90.II.G.1, February.
- Edquist, Ch. and S. Jacobsson (1988), *Flexible Automation: The Global Diffusion of New Technology in the Engineering Industry*, New York, Basil Blackwell Inc.
- Fajnzylber, Fernando (1989), *Industrialización en América Latina: de la "caja negra" al "casillero vacío"*, Cuadernos de la CEPAL series, No. 60 (LC/G.1534-P/Corr.1), Santiago, Chile. United Nations publication, Sales No. S.89.II.G.5, March.
- FCE (Fondo de Cultura Económica) (1987), *La reconversión industrial en América Latina, Bienes de Capital*, vol. VII, collection of papers, Primer Seminario Latinoamericano de Reconversión Industrial, Mexico City.
- Pérez Aceves, Luis Alberto and Ignacio Echavartía Valenzuela (1989), "Competitividad de la industria mexicana de bienes de capital", *Comercio exterior*, vol. 39, No. 8, Mexico City, Banco Nacional de Comercio Exterior, S.N.C., August, p. 698.
- UNIDO (United Nations Industrial Development Organization) (1985), *Analytical Report on the First Meeting of Experts on Capital Goods in Latin America* (UNIDO/IS.567), Vienna, 7 October.