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15446-E

Distr. LIMITED

ID/WG.458/9
9 January 1986

ENGLISH
Original: SPANISH

United Nations Industrial Development Organization

Fourth Consultation
on the Iron and Steel Industry

Vienna, Austria, 9-13 June 1986

INTEGRATED DEVELOPMENT BETWEEN THE IRON AND STEEL AND CAPITAL GOODS SECTORS: CONCRETE CASE STUDIES*

Prepared by

UNIDO secretariat

* This document has been translated from an unedited original.

V.86-50313 (EX)

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I. Introduction

The present document is based mainly on the discussions and analyses of case studies from various countries submitted by participants attending the ad hoc meeting of experts on strategies for more integrated development between the iron and steel industry and the capital goods industry, held at Vienna, Austria, from 16-18 October 1985.

The meeting was programmed in the context of the preparations for the Fourth Consultation on the Iron and Steel Industry, and it was attended by experts invited from Zimbabwe, France, Peru, Austria, Cuba, Czechoslovakia and India. The main aim of the meeting was to analyse development strategies and models for promoting integrated development between iron and steel and the other sectors of the economy, especially the capital goods industry, in the light of the present situation and the future outlook of development in the iron and steel industry at world level.

The most noteworthy conclusions and recommendations emerging from the meeting were the following:

(a) The developing countries must promote more interaction between the iron and steel industry and the capital goods industry so as to create a basis for a more independent and self-sustained economic and social development. If this strategy is to be successful, it must be based on the specific conditions obtaining in the national economies of each region: the availability of raw materials, the level of technical development and manpower training, and the basic needs of the population.

(b) In the light of their economic and social situation, the developing countries must focus the production of their iron and steel industries on the supply of basic inputs for the following sectors in particular:

(i) Infrastructure and construction;

(ii) Manufacture of agricultural and agro-industrial machinery;

(iii) Manufacture of transport equipment, especially for the railways;

(iv) Manufacture of mining equipment;

(v) Manufacture of machine-tools;

(vi) Manufacture of spare parts essential for the functioning of the industrial sector.

(c) The existing links between the iron and steel industry, capital goods and other sectors of the economy do not constitute an automatic process. Hence they must be the subject of long-term planning if integrated development is to be achieved.

(d) There is no single model for the planning of integration between the iron and steel sector and other sectors of the economy. Among the various planning options the following may be pointed out: (a) that based on "demand pull" from capital goods or the more dynamic sectors of the economy, and (b) that based on "demand push" from the iron and steel industry and designed to promote the expansion and diversification of the capital goods industry and other sectors. Generally speaking, however, there is a certain interaction between the processes referred to above.

(e) The iron and steel industry produces a product diversification limited in comparison with the great variety of inputs required for the development of the capital goods industry. Hence the various national policies and plans should attach great importance to the potentialities for regional and subregional development.

(f) To back up the integrated development of the iron and steel industry and that of capital goods, it is essential to plan and put into operation installations for other basic industries such as smelting, forging, thermal treatment and shaping of metals.

(g) The planning process in the developing countries must promote integrated development between the various iron and steel-making operations on the one hand and between the iron and steel industry and the capital goods industry on the other. To attain this, an important

political decision is called for.

(h) Cooperation among the developing countries and also between the developing and the developed countries must be interpreted in the framework of the achievement of more integration of the development of the iron and steel industry with the capital goods industry at national, subregional and regional levels. This cooperation must be based mainly on long-term agreements offering mutual benefits. UNIDO has an important function to fulfil in helping the developing countries to strengthen cooperation between them at regional and subregional level and in increasing their negotiating capacity.

(i) Training and the proper choice of technology are two essential factors in achieving integrated development between the iron and steel industry and the capital goods industry in most of the developing countries, especially the relatively less-developed. Similarly, due emphasis must be placed on achieving uniformity in the production of machinery and equipment with a view to avoiding unnecessary diversification which could cause difficulties in planning the iron and steel industry to respond to the needs of the capital goods industry.

(j) Mini-plant technology constitutes an interesting option worth considering by most of the developing countries because of the serious financial constraints being felt today by a fairly large number of developing countries. This is particularly true in the case of small countries where mini-plants can represent a satisfactory means of access to iron and steel production. However, mini-plants cannot replace other technological options for the production of a varied spectrum of iron and steel products such as is demanded for the production of machinery and equipment. Hence other technological options such as blast furnaces must also be taken into account when the most suitable technology is being selected.

(k) It was felt that integrated development on the basis of a country's own resources is only possible if educational and training programmes are

set up enabling the entire production subsystem constituted by the iron and steel industry and the capital goods industry to be mastered. Because of this, it was recommended that well-defined teaching and training courses should be prepared before a start was made with the execution of the projects. These programmes should be aimed not merely at the personnel in charge of the operation and maintenance of plants but also at executives, planners and those responsible for the establishment and implementation of policies in the iron and steel sector.

(1) It was recommended that UNIDO should continue to prepare studies, hold consultations and provide technical assistance at regional and sub-regional level with a view to helping to strengthen the links between iron and steel and the capital goods industry.

II. A brief review of the countries studied

1. General

In the case studies analysed it was possible to observe a marked difference in the approach to development of the iron and steel industry and its interrelations with the other sectors of the economy as between the developed and the developing countries. Similarly, differences could be detected between the various developed countries, and also between developing countries, arising out of the different economic and social characteristics of each of them.

One of the main differences to be observed between developed countries and developing countries is that, generally speaking, in the developed countries studied the iron and steel industry and the capital goods industry have followed a progressive and continuous process of development. In the developing countries, these industries emerge in many instances in their present-day form without any prior process of steady development generated by the transformation of small undertakings into large-scale units or of evolution from traditional technology to modern technology; the iron and steel industry is established more often than not on the basis of a modern plant with imported technology.

In the developed countries there is considerable interplay between the iron and steel industry and the capital goods industry, which has existed since these industries began to develop in response to the need for machinery and equipment felt by the economic sectors that at the time exerted the drive towards development. The emergence of what is known as a modern iron and steel industry has come about in those countries mainly as the result of the growing need for steel in the wake of railway development. In the developing countries, the interplay is basically, at the outset, between iron and steel and the construction sector, and as a result of this sector's need for steel, the iron and steel industry has developed right from the start in its modern form.

It is important to point out that while in general there has been no continuous development in the iron and steel industry and the capital goods industry in the developing countries, nor any integration between them from the early stage of their development, there are nevertheless exceptions in certain developing countries which have an industrial base of some size. Thus, for example, we find that in Argentina and Brazil, which witnessed relatively early the development of the iron and steel industry and the capital goods industry, there has been a continuous process in the development of these industries which began with small smelting and forging plants, and maintenance and repair shops, operated by foreign distributors and importers[1/].

Mass production in the automobile and domestic electrical appliance industries, which are the main users of iron and steel, encouraged the establishment of large-scale iron and steel units in the developed countries until nearly the end of the 1970s. This in turn made for a high degree of internal interaction between the iron and steel industry and the other key sectors of the economy, thus contributing to the establishment of a coherent productive process at national level.

Mass production in the sectors which are the main users of steel in most of the developing countries is distinctly limited, and this means that many developing countries try to base the drive of their iron and steel industry on exports, or in other instances they operate at relatively low levels of capacity. This in some cases is due to a lack of proper planning and selection of technologies and the absence of adequate subregional and/or regional cooperation programmes.

In general, the developed countries produce the technology, as well as the machinery, equipment and spare parts needed by their iron and

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1/ For more details see: "Posibilidades y modalidades de desarrollo entre la industria siderúrgica y los otros sectores de la economía, en países latinoamericanos", background document for the Fourth Consultation on the Iron and Steel Industry, Vienna, Austria, 9-13 June 1986.

steel industry for its expansion. The developing countries on the whole import both the technology and the machinery they require, and in some cases they confine themselves to the manufacture of certain specific components and spare parts required by their iron and steel industry for its normal functioning.

The main motivation for iron and steel development is marked by certain differences according as the countries are developed or developing. Whereas in the former countries it is mainly in response to the machinery and equipment requirements of the various economic sectors, in the case of developing countries the motivation is based on making use of the natural resources they have at their disposal, such as iron ore, coal, energy, etc.

The countries studied, both developed and developing, can be seen to have one feature in common, namely the direct participation of the State in iron and steel development, especially in regard to production for the capital goods industry. In some instances, one and the same State institution or undertaking is in charge of the development both of the iron and steel industry and of the capital goods industry.

Among the developed countries studied, there are differences between the approach to development by the iron and steel industry and the capital goods industry. While in all instances, in the early days of their development there was integration, virtually without intervention, between these industries, subsequent development has shown a tendency, exemplified in one of the cases, for iron and steel undertakings to specialize almost exclusively in iron and steel production, whereas in other cases, undertakings have tended rather to diversify their production, manufacturing capital goods and electronic products. In the cases where specialization was chosen, production intended directly for the capital goods industry has been limited, trade and imports playing an important part in the supply of steel for the production of machinery and equipment.

The crisis in iron and steel has had a different impact according to the developed countries studied, the incidence being greater in cases where the iron and steel undertakings concentrated almost exclusively on iron and steel production, causing a substantial reduction in installed capacity and generating less interaction between the iron and steel industry and the capital goods industry. Other countries, where iron and steel undertakings have had a greater degree of diversification, have absorbed the impact of the crisis better.

There are also differences between the developing countries studied in regard to the approach to development adopted by the iron and steel industry. In some cases, iron and steel has turned its attention exclusively to internal development, while in others, exports have played a fairly significant role in the dynamics of their development.

In these countries there are likewise differences in regard to the type and degree of closeness of relations between iron and steel and the other economic sectors. In some cases, iron and steel production has focused exclusively or almost exclusively on the construction sector, whereas in others, the production of flat products for mechanical engineering has acquired a certain relevance.

In the developing countries studied, the degree of planning of development in the iron and steel industry and its interrelations with other sectors has varied. There are cases where planning has played a limited part, and others where the development of the iron and steel industry and the capital goods industry reflects a process of central planning.

2. Czechoslovakia

2.1 The trends in the iron and steel industry and the capital goods industry

In Czechoslovakia, iron and steel production was developed at the outset in small workshops, whose main object was to supply agriculture with tools. By the end of the 18th century, steel production amounted to 13,000 tons; Czechoslovakia at that time took fourth place in the production of steel in Europe, and it developed at a tremendous pace from the 19th century onwards. In 1830, the first large iron and steel plant was built at Vitkovice; it devoted its production mainly to supplying the demand created by the development of railways and the mining industry.

The development and availability of steel promoted the development of engineering workshops, of which there were 35 by 1857. These workshops produced steam engines, textile machinery, and equipment for railways, distilleries, tanneries, etc. The year 1869 saw the birth of the SKODA works, one of the undertakings which has had the greatest impact on the development of the iron and steel industry and the capital goods industry in Czechoslovakia. At the outset, this plant focused on the production of agro-industrial equipment. Later on, it set up a modern iron and steel plant, which made it possible to expand its activities to the production of water craft; and at the end of the 19th century, it began the manufacture of electrical equipment such as generators and electric motors.

During this period, interaction between the iron and steel industry and the capital goods industry was characterized at first by integration based largely on the dynamic nature of the steel production at the Vitkovice plant, which led to vigorous development in the capital goods industry. Subsequently, dynamic relations between these industries came about through the need for steel for SKODA's machinery and equipment production. This allowed SKODA to gain a foothold in the iron and steel industry.

At the present time, the Czech iron and steel industry produces approximately 15 million tons of steel, and it is estimated that by the year 2000, approximately 50% of steel production will make use of the continuous process.

2.2 The iron and steel industry and its relations with the other sectors

The situation today

In Czechoslovakia there is a high degree of integration between steel production and that of machinery and equipment. This may be seen in the following table:

Table 1

Relations between Steel Production and Machinery and Equipment Production in the Eastern European Countries and the USSR

	1961-1965	1974-1978	1986-1990
Czechoslovakia	0.55	0.38	0.25
Bulgaria	0.42	0.26	0.16
Hungary	0.47	0.32	0.20
German Democratic Republic	0.35	0.26	0.18
Poland	0.45	0.22	0.09
Romania	0.31	0.17	0.08
Soviet Union	0.46	0.25	0.17

Source: O. Mesaros: "Integrated Development of the Iron and Steel Industry and the Capital Goods Industries. The case of Czechoslovakia". October 1985, page 9.

As may be observed from the above table, Czechoslovakia has the highest ratio between steel production and the production of capital goods

among the planned economy countries. It may also be noted that both in Czechoslovakia and in the other countries there is a marked trend towards reducing this ratio by means of more efficient use of steel and modifications in the structure of capital goods production, with a tendency to produce machinery and equipment using less steel. The main users of the steel produced in Czechoslovakia are mechanical, electrical and electronic capital goods. Over the last 10 years this type of machinery and equipment accounted for between 64% and 68% of steel production. Another sector which is a large steel consumer is construction, which accounts for 17% to 21%.

The iron and steel industry in Czechoslovakia was set up and developed basically for internal purposes, not as an export industry. Nevertheless, for a whole series of reasons, mainly lack of foreign currency, the industry has been gradually turning towards exports. Whereas in 1960, exports of iron and steel products represented 16% of production, by 1970 the figure had grown to 28%, and at the present time it represents practically a third of the iron and steel produced.

2.3 Iron and steel development policies

Development plans at national and sectoral level since the Second World War have promoted the integrated development of the iron and steel industry and the capital goods industry. Similarly, to strengthen the integrated development of these industries, both have been placed under the direction of the Federal Ministry of Metallurgy and Heavy Engineering Industries. Policy decisions, investment priorities and research and development programmes for these industries are coordinated from one and the same decision-making centre.

The policies which have governed the development of iron and steel in Czechoslovakia were directed at the outset towards helping to meet the basic needs of the population by supplying iron and steel inputs for

agriculture, agro-industry and house-building. They were also designed to make rational use of the national resources available and to strengthen the direct and active participation of the State in the development of the iron and steel industry.

A high priority was given to education and training in the iron and steel sector from the early days of development of the industry. Thus we read of the establishment at Jáchyimov of the world's first school of mining and metallurgy. Mechanical engineering, as a separate speciality, was introduced into the university in 1863. Today, a vast range of training schools and institutes provide the iron and steel and capital goods industries with skilled technical personnel.

3. Austria

3.1 The trends in the iron and steel industry and the capital goods industry

The iron and steel industry in Austria was nationalized almost entirely at the end of the Second World War. Because of this, Austria's iron and steel industry is almost synonymous with the State undertaking VOEST-ALPINE, which from its very beginnings has produced both iron and steel products and machinery and equipment.

Iron and steel in Austria achieved a considerable level of development after 1952, as a result of the development and practical application of the process based on the blast furnace (Linz-Donawitz process). This important technological advance in the iron and steel field led VOEST-ALPINE to focus its capital goods production on the manufacture of machinery and equipment for the iron and steel industry. Thus we find that during the period between 1955 and 1971, VOEST-ALPINE installed six iron and steel plants using the Linz-Donawitz process. In the 1960s, it tended to increase the diversification of its capital goods production

through the manufacture of machinery and equipment for basic industries such as chemistry, the cement industry and pulp and paper.

Austria's iron and steel industry has practically from the start been an important supplier of flat products for the European automobile industry, later diversifying its iron and steel production by producing special high-grade steel. During the 1970s, the industry began a process of restructuring which coincided with the iron and steel crisis of the mid-1970s. In this process, there was a tendency to reduce the share of iron and steel production in VOEST-ALPINE's overall production, and the activities of the engineering and contracting sectors were increased, reaching 41% of the undertaking's total sales in 1983.

In 1984, production by the Austrian iron and steel industry amounted to 4.7 million tons of steel, which puts the country in the 23rd position among the world's steel producers with a contribution of nearly 0.8% of world production. Nevertheless, it may be well to point out that VOEST-ALPINE is at present passing through an economically difficult period.

3.2 The production diversification process. The situation today

The VOEST-ALPINE has continued to build iron and steel plants using the Linz-Donowitz process. The most recent examples are the plant at Eisenhüttenstadt, in the German Democratic Republic, with a production capacity of 2.2 million tons, and another in Mexico, with a capacity of 900,000 tons per year. VOEST-ALPINE is also building plants for direct reduction. Thus towards the end of 1984 a direct reduction plant was completed at Shapa, Malaysia, with an annual production capacity of 715,000 tons.

Apart from the production of iron and steel machinery and equipment, VOEST-ALPINE is continuing with the installation and construction of plants for the heavy industries, which began manufacturing in the 1960s. This range includes ore-processing, petrochemical, pulp and paper, chemical and thermal energy plants, to mention only the more important.

At the present time, there is a tendency to turn over gradually from the production of machinery and equipment for basic industry to manufacture using more automated technology and precision engineering as well as micro-electronics. Similarly, over the last few years VOEST-ALPINE has stepped up its activities in the fields of environmental engineering and energy-saving technologies.

4. France

4.1 The trends in the iron and steel industry and the capital goods industry

Prior to the appearance of modern iron and steel-making in France, the production of steel was carried out in a scattered series of small production units situated in the neighbourhood of iron ore deposits, sources of supply of fuel (forests, charcoal, etc.), or energy sources. The early iron and steel experts did not devote themselves exclusively to steel production; they also undertook the production of capital goods for agriculture (agricultural implements for animal traction, agricultural tools, etc.), the transport sector, and also the construction sector.

The emergence of modern iron and steel-making in France dates from the middle of the 19th century, and resulted from the development of the railways. The need for the speedy establishment of a railway infrastructure, calling for high-resistance steel, led to the need for large quantities of mass produced steel, and also higher quality steels. These new requirements were met by the Bessemer process during the 1850s and the Martin process during the 1860s.

The development of these new iron and steel-making processes takes place in general in the same areas where the traditional iron and steel-making was developed, namely the central region of France (the Massif Central). In 1869, of 16 Bessemer converters installed in France, 14 were located in Central France. In the same way, of 23 Martin furnaces

installed, 22 were located in central France. In 1878, of 24 Bessemer converters installed, 22 were located in central France, and of 44 Martin furnaces, 41 were installed in the same region. Since that time, Le Creusot and Saint-Etienne have consolidated their status as zones of iron and steel development. In these places also, a marked integration with the capital goods industry has been established. During the period in question, heavy machinery was produced at Le Creusot, while at Saint-Etienne the emphasis was on light machinery and equipment, bicycles and arms manufacture.

The introduction of the Thomas process brought about a transformation in the approach to development of the iron and steel industry in France, affecting its location and its interaction with the capital goods industry. This process, which makes it possible to process phosphated ores, enables the phosphated ores of Lorraine, Luxembourg and Belgium to be used, and this explains why the first Thomas converters, installed in 1880, are to be found in Lorraine and northern France.

This marks the beginning of the process of migration of iron and steel-making in France from central France to the east and north of the country. Thus in 1974, 90% of steel in France came from the east and north, and only 5% was produced in the central region. Later on, the replacement of the Thomas process by the L-D process meant that iron and steel-making, located in central France and Lorraine, gave way to the new iron and steel-making plants installed along the coast (Dunkerque in the north and Fos-sur-Mer on the Mediterranean coast).

In the course of the migration of iron and steel-making towards the east, the north and later the south, where the main motivation was mass production, no capital goods complex similar to those of Le Creusot and Saint-Etienne was generated. The large iron and steel plants in France have become more or less autonomous production units, selling either directly or indirectly to the final users, who are also autonomous. At the present time, the steel undertaking at Fos-sur-Mer exports or sends to the north of France, 800 kilometres away, more than

95% of its production.

On the basis of the foregoing, it may be pointed out that the main trend of iron and steel-making and capital goods was a marked direct integration between the iron and steel industry and capital goods until about 1880, after which it gradually turned into a fairly specialized industry. This does not mean that a large proportion of its production was not earmarked for capital goods production; it means that the iron and steel undertakings did not tend to diversify in the direction of capital goods production as in other countries such as Germany and Japan, to mention outstanding examples.

Today, the French iron and steel industry is going through a difficult period due to the crisis which has gone on since 1974. Steel production in France in 1984 was 19 million tons, in other words there was a decline of 30% in relation to the 1974 level. The falling-off in production has brought with it serious consequences for the use of the installed capacity, employment, and the financial situation of the undertakings. The drop in production has meant that a number of installations in the north of the country, and particularly in Lorraine, have closed down. Employment fell by some 46.1% between 1974 and 1984, and it is forecast that it will fall even further. The financial situation of the undertakings has grown steadily worse, the annual losses amounting to approximately 10 billion francs.

The iron and steel crisis in France has demonstrated the structural weakness of direct relations, with no intervention, between iron and steel and the capital goods industry. The dismantling in 1984 of the Creusot-Loire undertaking, which was both an important iron and steel plant and the first producer of capital goods in France, is the most recent manifestation of this process of decline in the organic relations between iron and steel-making and the capital goods industry.

4.2 The iron and steel industry and its relations with the capital goods industry. The situation today

In 1980, 77% of iron and steel production involved productive investment and 23% consumption (cars, electrical household equipment, etc.). Approximately 40% of iron and steel production went into the manufacture of capital goods, roughly the same proportion as direct exports.

Integration today between iron and steel-making and capital goods in France is made more difficult because of the widely scattered nature of the final users. For example, the average tonnage of steel per month per establishment used in the machine construction field is 39 tons, whereas in metal construction it is 6 tons per month per establishment. This dispersal favours the existence of a whole decentralized trade apparatus acting as middlemen between the iron and steel producers and the capital goods industry, at the same time encouraging imports. In 1981, 47% of flat products were sold directly to the final users, while 35% of sales were carried out through commercial establishments and approximately 18% of sales came from direct imports.

At the present time, the two main iron and steel works in France - the State undertakings Usinor and Sacilor - devote most of their production to the manufacture of iron and steel products, the figures in 1982 being 75% at Usinor and 64% at Sacilor. The production of capital goods by these undertakings does not go beyond primary processing and metal construction, and it represented 9.4% of the overall production at Usinor and 13.3% at Sacilor.

This trend in the large iron and steel works in France towards specialization is in sharp contrast to the growing diversification found in the large plants in Japan and Germany, which have tended to produce capital goods on a considerable scale. Thus we find that of the total sales of the Kawasaki Group in 1984, only 47% were iron and steel products, and heavy machinery and ship-building amounted to 35%. In the Krupp Group, sales of iron and steel products were only 28% of total sales, those of capital goods 43%.

Sales of iron and steel products by the Thyssen Group in 1963 represented only 30.6% of total sales, with capital goods at 26.1%, while in the Mannesmann Group, sales of iron and steel products in 1976 were only 10.6% of total sales, those of capital goods 61.3%.

5. Peru

5.1 The trends in the iron and steel industry and in the utilization of iron and steel products

The development of the iron and steel industry in Peru is concentrated mainly in the State undertaking Sider-Peru. The production capacity of this undertaking has evolved as follows:

a. Between 1957 and 1967, the installed capacity for production was 108,000 tons, working with two "Elkem" electric arc furnaces.

b. In 1968, a blast furnace was put into operation for steel production, and production capacity increased by 260,000 tons of liquid steel. This, added to the 108,000 tons mentioned above, brings the total capacity to 368,000 tons.

c. In 1972, the electric furnace transformers were changed. This increased their production significantly and raised the overall capacity of the plant to 420,000 tons.

d. Production capacity rose to 550,000 tons in 1977 with the entry into operation of two new electric arc converters. The crisis afflicting the country, and particularly the iron and steel industry, has made it impossible for Sider-Peru to implement its expansion plans. It should also be pointed out that iron and steel expansion over the last few years has been mainly due to the expansion of a private undertaking - Aceros Arequipa.

Since the mid 1970s in particular, iron and steel production has at all times been far below the level of the installed capacity. Thus, for example, steel production in 1979 was 378,809 tons; it then increased to 406,955 tons in 1980, fell off considerably in 1981 and 1982, but increased again slightly in 1983. In this latter year, steel production was 268,471 tons, approximately 39% of the overall installed capacity of the country, including both the public and the private sector.

It may be mentioned that the production of flat products diminished more markedly than that of other products. Thus the share represented by flat products in the production of rolled products fell from 40.6% in 1979 to 36.3% in 1983.

It may be worth mentioning that the production of flat products is concentrated in the Sider-Peru undertaking, whereas that of other shapes is shared by the private sector. In the following table, we show the proportion represented by Sider-Peru, Aceros Arequipa and imports, in Peru's steel consumption for 1983.

Table 2

Steel Consumption in Peru
(Year 1983)

	Sider-Perú	%	Aceros Arequipa	%	Imports	%
Flat products	87,765	85.1	—	—	15,384	14.9
Other shapes	89,415	50.6	64,821	36.7	22,597	12.8
Seamless tubes	-	-	-	-	12,277	100.0
Production by undertaking and total coverage	177,180	60.6	64,821	22.2	50,258	17.2
Total production and imports			292,259			

Source: Sider-Perú, Aceros Arequipa, and Laminadora del Pacífico.

With regard to the destination of the iron and steel produced, the main user is the construction sector, which accounts for approximately 53% of Peru's iron and steel products. The second largest user is the dairy produce industry, which consumes tinplate produced using imported spools. The third largest consumer is the mechanical engineering industry, which absorbs some 10% of production. After that comes mining, with 7%.

With regard to the utilization of iron and steel products by the capital goods industry, there was a decided falling-off in demand for billets by the producers of equipment and machinery during the period 1981-1983. Apparent consumption of billets by these producers fell from 7429 tons in 1981 to 1021 tons in 1983 while, direct sales of billets by Sider-Peru fell from 3227 tons in 1981 to 705 tons in 1983.

The falling-off in demand for iron and steel products by the producers of equipment and machinery is explained by the considerable decline in demand for capital goods by the fishing, mining and manufacturing industries. The fisheries industry, one of the sectors most closely bound up with the local production of capital goods, uses hardly more than 10% to 20% of its installed capacity.

The trend in apparent consumption and sales of billets by Sider-Peru, by type of user, is as follows:

Table 3

Trend of Apparent Consumption and Sales of Billets by Sider-Peru

Type of use	1981		1982		1983	
	Direct sales	App. cons.	Direct sales	App. cons.	Direct sales	App. cons.
Equipment and machinery	3,227	7,429	2,417	3,145	705	1,021
Hoppers, vehicle bodies, crash barriers, etc.	1,280	1,958	530	530	723	723
Mining and petroleum	5,478	9,698	1,494	2,056	2,398	2,644
Construction	366	1,436	285	285	342	342
Agricultural cooperatives	344	344	322	322	46	46
Special tubes	574	1,818	164	164	168	168
Water craft	220	10,255	122	1,279	118	270
Business concerns	8,348	14,376	5,721	11,938	3,043	3,107
TOTAL	20,237	47,314	11,055	19,719	7,543	8,321

Source: Sider-Peru, Annual Sales Report 1983

Consumption of thin bars, like that of billets, showed a marked contraction during the period 1981-1983, while much the same was true of demand for both types. Demand by business concerns, which is important both for billets and for thin bars, indicates the vital part played by the middleman in the Peruvian economy.

The following table shows the trend of apparent consumption and sales by Sider-Peru of thin bars, by type of user.

Table 4

Trend of Apparent Consumption and Sales by Sider-Peru of Thin Steel Bars

Type of user	1981		1982		1983	
	Direct sales	App. cons.	Direct sales	App. Cons.	Direct sales	App. cons.
Equipment and machinery	2,392	2,816	1,436	2,814*	963	1,028
Hoppers, vehicle bodies, crash barriers, etc.	1,792	3,700	688	1,341	143	326
Mining and petroleum	1,556	2,458	326	326	195	195
Construction	178	178	335	335	59	59
Agricultural cooperatives	36	36	36	36	40	40
Special tubes	182	182	32	32	62	62
Water craft	24	24	25	168	138	138
Business concerns	4,803	10,325	3,088	6,446	1,965	1,965
TOTAL	10,963	19,719	5,966	11,498	3,565	3,812

* including 497 metric tons of tool-steel grade spools.

Source: Sider-Peru, Annual Sales Report 1983

5.2 The crisis and the development of the iron and steel industry

The prolonged crisis through which Peru has been passing has considerably altered the pattern of development of the Peruvian economy, and in particular the iron and steel industry. In the context of the economy, mention should be made of the fall in the prices of Peru's export products, its high external debt payments, and more recently the falling-off in the flow of external credit. All this has affected the growth of national production and consumption of steel. Peru's gross domestic

product, which increased by 3.8% in 1979, showed only 0.7% growth in 1982, and a fall of 12.1% in 1983.

The trend in steel consumption did not coincide exactly with that of national production, although the same tendency was to be observed. In 1982, consumption fell by 29%; it was 50,000 tons less, or more than 10% less, than the consumption figure for 1980. The following year, consumption fell by 23%, so that in no more than two years, consumption fell to a level equivalent to 78% of the 1979 consumption.

It is interesting to observe, as an expression of the crisis, that the consumption of flat products and other shapes rose in virtually the same proportion during the period of expansion, but fell by different proportions during the period of contraction. Thus, apparent consumption products other than flat products in 1983 fell to the same level as in 1979, whereas the consumption of flat products in 1983 was equivalent to 60% of the 1979 consumption.

One factor which contributed to the falling-off in national production of steel during the crisis period was the increase in imports, in particular imports of products which compete with those manufactured in the country. Actually, the increase in the consumption of iron and steel products was based mainly on imports. Thus in 1983, imports represented 19% of total consumption, whereas in 1979 it had been only 12%.

5.3 The impact of development policies on the iron and steel industry and on its relations with the capital goods industry

From the middle of 1980 onwards, the process of import liberalization begun in 1979 was accelerated. On the one hand, the ban on imports of products which might compete with those manufactured locally was lifted. On the other hand, there was a drastic reduction in tariff rates, especially those applicable to rods for building. The idea was

that the market forces would act fairly freely and decide matters; nor was the idea of closing down the State iron and steel works excluded. Subsequently, in April 1982, the "prior licence" (import licence) was established. By this means, the authorities are in a position to exercise a sort of permanent prohibition. Since 1983, there has been a rise in the tariffs for tax purposes, but this does not have the same impact as the import licence.

According to a recent study on the rehabilitation of the Sider-Peru plant (May 1984), it was suggested that Sider-Peru should gradually hand over the market for products other than flat products to the private sector, whereas in regard to the production of flat products it would have the virtual monopoly. Obviously, this only refers to the lines of products manufactured by Sider-Peru. What this means in concrete terms is that the development of iron and steel production intended for the capital goods producing industry is concentrated in a single undertaking. On the capital goods side, there are several dozen undertakings, of which about 20 account for most of the production. Thus, closer links between the capital goods producing industry and the iron and steel industry must be brought about through coordination of plans and programmes by a limited number of undertakings.

The new policy lines being implemented today in Peru, designed to give priority to meeting basic needs, will have to pay special attention to the integration of the iron and steel industry with the production of machinery and equipment for agriculture, the production of equipment for the fisheries industry for human consumption, the production of machinery and equipment for the textile, leather and footwear industries, and the production of goods needed to develop the education and health services.

6. Cuba

6.1 The trends in the iron and steel industry and the capital goods industry

Production capacity in Cuba up to 1959 was approximately 100,000

tons of rolled steel. Iron and steel production up to that time had been largely catered for by two workshops which produced rods for reinforced concrete, using as raw materials steel axles and railway rails.

In May 1959, for the first time, steel was produced in a semi-integrated plant consisting of two Martin furnaces of 70 tons end a billets mill. Iron and steel capacity today is approximately 400,000 tons of corrugated bars and heavy wire. This has turned out to be insufficient to meet the growing demand for steel products by the various sectors of the economy. At the present time, the demand for iron and steel products amounts to 1 million tons.

With regard to the development of the capital goods industry, during the first phase of its development it was focused on the production of agricultural machinery and equipment with a view to mechanizing the cultivation and harvesting of sugar cane, and diversifying crops.

The mechanization of the sowing, cutting and harvesting of sugar cane generated a growing demand for seed-sowing machines, cultivators, fertilizer-sprayers, harvesters and trailers. The transformation of the agricultural production structure boosted the demand for ploughs, harrows, carts and weeding equipment.

Today, Cuba produces most of the machinery and equipment required by the agricultural sector. The main items of production include:

(a) Ploughs
(b) Harrows
(c) Graders and furrow cutters
(d) Sowing and transplanting machines
(e) Fumigators
(f) Combines and harvesters
(g) Sugar-cane carts
(h) Agricultural trailer-carts
(i) Mechanical milking equipment.

The priority given in our development plans to the construction of hospitals, schools and highways, and to the increase in electricity generation, has created a brisk demand for machinery and equipment by the construction sector, and also for steel products, mainly rods for reinforced concrete and steel wire. The building sector has come to consume approximately 40% of the total consumption of rolled products.

In response to the growing need for mechanization of the construction sector, the capital goods industry is today producing a whole range of machinery and equipment for this sector, the following being the main items of production:

(a) Concrete-mixers
(b) Compactors
(c) Truck-mounted concreters
(d) Tractor-loaders
(e) Front loaders
(f) Truck-mounted cranes.

Also being produced today is all-purpose machinery and equipment such as machine tools for industry and specialized equipment for priority industries such as sugar, food and chemicals. At the same time, capital goods are being produced for public transport and haulage - vans, lorries and buses.

The Cuban engineering industry also produces a certain amount of equipment and components for iron and steel-making, as a result of the experience gained in the construction of sugar mills. Up to the present, the articles produced have been sprockets, gear-boxes, clutches, axles, gear differentials and rolling mill components.

6.2 Plans for the future development of iron and steel

With a view to coping adequately with the demand for iron and steel products, an iron and steel development plan has been formulated which

would raise Cuba's steel production capacity to 1 million tons by means of the following main investments:

1. Installation of an electric steel mill with two 50-ton furnaces and continuous casting machinery, which is already in the first stage of construction, and the installation of two further 50-ton furnaces during a second stage.

2. The installation of a "350" rolling mill for light and medium shapes (already under construction), for the production of round, square and hexagonal bars, even and uneven angle shapes and U-beams.

3. The installation of a cold-roller shaping unit of 70,000 tons a year, already at the operational stage, which at the outset will use imported hot-rolled spools and will subsequently be supplied from national production. These shapes will be used basically for the production of metal structures and agricultural and transport equipment.

4. The construction of a mini-plant for flat steel products (carbon and stainless), comprising electric furnaces, continuous casting, degasification installations, a Steckel-type rolling mill and auxiliary facilities, with a capacity of approximately 200,000 tons of steel a year. In the first stage, it will produce hot-rolled bars, and sheets of 2 to 6 mm, for use by the engineering industry and the cold-rolled shaping unit, and spools of stainless steel, for domestic consumption and export.

5. The installation of a wire-drawing plant with a capacity of 100,000 tons a year for the production of wire, steel mesh, cables, and screws, bolts and the like.

6. The installation of a plant for the production of ferro-manganese and silico-manganese.

7. Over the longer term, there are plans for using the residues from nickel plants for the production of steel in integrated plants. For this

purpose, analyses are being made of various technological options, and tests are being carried out with the ore on an industrial and semi-industrial scale.

7. India

7.1 The process of development of the iron and steel industry and the capital goods industry

Before it achieved independence in 1946, India had a steel producing capacity of approximately 1.25 million tons a year, concentrated in two iron and steel mills. There were also 32 re-rolling mills with a capacity of 75,000 tons working with railway scrap.

Prior to independence, iron and steel-making provided products mainly for the construction sector, both residential and non-residential (bridges, etc.). Similarly, it provided iron and steel products for the construction of the railway network and for the manufacture of agricultural implements and tools required by the agricultural sector.

Between 1951 and 1960, the period embracing India's First and Second Development Plans, the iron and steel industry continued to give special attention to its articulation with the sectors mentioned above, and during this period it embarked on the production of tubing.

During the period of the Third Plan, 1961-1966, iron and steel production gave great importance to its relationship with the motor vehicle industry, providing it with the steel needed for the construction of vehicle bodies. It also gave priority to its connection with the food industry, providing it with the iron and steel inputs needed for the manufacture of receptacles. During the period 1969-1974, the iron and steel industry provided the products needed for the manufacture of machine tools, motors, machinery and equipment for the chemical and food industries, and also for the production of electrical machinery.

During the period 1975-1985, which includes the Fifth and Sixth Development Plans, the iron and steel industry strengthened its relations with businesses producing water craft and electrical machinery, and with the railway and agricultural sectors - in the case of agriculture, particularly for the promotion of irrigation schemes. Between 1979 and 1980, approximately 56% of the steel was consumed by the capital goods industry, while the construction sector consumed 44%. In 1984-1985, consumption by the capital goods industry increased to 58% and that of the construction sector fell to 42%.

The following table shows the consumption of steel by the various machinery and equipment producers and the construction sector, in 1979-1980 and in 1984-1985.

Table 5

Consumption of Steel by the Capital Goods Industry and the Construction Sector in India, 1979-1980 and 1984-1985

	Consumption (millions of tons)	
	1979-80	1984-85
1. Production of machinery and equipment	4.50 (56%)	7.472 (58%)
a) Transport equipment	0.726	1.230
b) Electrical equipment	0.197	0.347
c) Industrial machinery	0.401	0.645
d) Small-scale industry	1.394	2.316
e) Miscellaneous	1.782	2.934
2. Construction sector	3.50 (44%)	5.40 (42%)
	8.00	12.872

Source: India's Sixth Development Plan

8. Zimbabwe

8.1 The trends in the iron and steel industry and the capital goods industry

In 1965, the production capacity of the iron and steel industry in Zimbabwe amounted to 400,000 tons. In 1970, a large expansion programme was undertaken with the collaboration of the Austrian undertaking VOEST-ALPINE, with a view to introducing the modern technology of continuous processing. For the purpose of this investment programme, the State granted the Ziscosteel works a loan of $92 million, raising the State's participation in the ownership of the plant to 50%. At present, the State holds 49.3% of the shares. In 1980, Ziscosteel achieved a record production of 804,000 tons, the figure falling to 700,000 tons in 1982.

The production drive in Zimbabwe today is based mainly on exports, which in 1983 represented approximately 77% of sales; and the anticipated sales by Ziscosteel in 1985 indicate that exports are likely to represent approximately 82% of the undertaking's overall sales. While Ziscosteel's exports go mainly to regions outside Africa, the undertaking is an important source of iron and steel products for the region, particularly for billets, which are used as inputs by various undertakings in East Africa and southern Africa. Thus in 1983, regional sales of billets amounted to 52,400 tons, a figure which exceeded the sales for Zimbabwe's internal market, namely 43,900 tons.

Between 1981 and 1984, Zimbabwe consumed an annual average of 141,000 tons of Ziscosteel's products, and during the same period it imported an average of 11,000 tons of heavy shapes and 100,000 tons of light rolled products and bars.

The main Ziscosteel products for the domestic market are semi-finished products for the manufacture of wire, medium sectional products for construction and light shapes for the production of agricultural implements.

The production of capital goods is insignificant, the most important item being metal products, followed by engineering construction machinery, particularly agricultural implements, with electrical machinery representing a smaller proportion. A good deal of the equipment of the transport sector cannot be regarded as capital goods but rather as consumer durables, inasmuch as it refers to the whole range of private cars. The following table shows value added for the various activities producing capital goods in Zimbabwe.

Table 6

Value Added for the Capital Goods Producing Industries in Zimbabwe

(in thousands of dollars at 1975 constant prices)

	1970	1975	1980
381	46.7	76.6	77.1
382	19.7	32.2	32.5
383	15.1	24.8	25.0
384	28.1	33.8	31.2
TOTAL	179.3	381.6	280.1

Source: "Prospects of an Integrated Development of the Iron and Steel Industry and Capital Goods: East and Southern African Countries", background document for the Fourth Consultation on the Iron and Steel Industry, Vienna, Austria, 9-13 June 1986.

Interaction between the iron and steel industry and the capital goods industry in Zimbabwe is confined mainly to the supply of iron and steel products for the manufacture of agricultural equipment, the rest of the capital goods production being based on imported flat products. The production of flat products within the country would substantially increase the articulation between the iron and steel industry and the capital goods industry.

Agricultural equipment, which Zimbabwe now produces, consists of a great variety of items such as agricultural implements, both for animal traction and for tractors, irrigation equipment, and simple equipment for

the tobacco and coffee industries. The firms producing this equipment have been able to create appropriate designs for the manufacture of agricultural implements which will suit local conditions. A large part of the manufacture of agricultural implements is based on national steel. Imported steel is used for making special implement components, but it represents only a small proportion, both in volume and in value.

8.2 Policies and cooperation for the development of the iron and steel industry and the capital goods industry

Zimbabwe's iron and steel development should be looked at in the context of the development of the entire subregion consisting of the countries of East Africa and southern Africa. This is based largely on the fact that important structural relations have been developed between Zimbabwe and these countries, and also that it is difficult to envisage Zimbabwe developing a coherent productive process at national level without adequate complementation with the iron and steel industry of the countries of East Africa and southern Africa.

Some countries of East Africa and southern Africa (Ethiopia, Kenya, Angola, Tanzania, Uganda) at present possess small plants producing on the basis of scrap iron (generally imported), and insufficient to meet the internal needs for iron and steel products, so that they need to import; and some of their imports come from Zimbabwe. On the other hand, in other countries of the region there are also plants operating on the basis of imported billets, and Zimbabwe is one of the suppliers.

Zimbabwe's iron and steel industry has been directing its production mainly towards exports, especially exports of semi-manufactures, and it is anticipated that this situation is not likely to change over the next 10 years. It is estimated that on an average there should be a surplus production of 500,000 tons a year for export.

The foregoing, combined with the world crisis in iron and steel, which has increased protectionist practices, points to the vital need to co-ordinate plans and programmes for the development of the iron and steel

industry of the subregion of East Africa and southern Africa, and its main users, namely the construction sector and the capital goods industry.

At the Sixth Meeting of the Council of Ministers held at Lusaka in February 1983, it was recommended that the iron and steel production of Ziscosteel should be increased and diversified with a view to meeting the requirements by way of iron and steel products of the countries of East Africa and southern Africa by the year 2000. Another recommendation was the installation of direct reduction plants in Angola and Mozambique, to meet these countries' need for sponge iron up to the year 2000.

The iron and steel development of this subregion should be directed towards the progressive and coordinated production of iron and steel products for the manufacture of machinery, equipment and spare parts needed by the priority sectors and clearly set out in the Lagos Plan of Action, namely food production, transport, communications and energy.