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Issue Paper I

THE IRON AND STEEL INDUSTRY:

PRESENT SITUATION, PROSPECTS AND THE NEED FOR MORE
INTEGRATED DEVELOPMENT OF THE IRON AND STEEL AND
CAPITAL GOODS INDUSTRIES *

Prepared by the
UNIDO secretariat

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1. Introduction

The economic growth of developing countries in the last two decades can be attributed mainly to the process of industrialization. However, most models of industrialization have not been able to contribute in a decisive way to solving the problem of unemployment, nor to improving income distribution in those countries.

In many developing countries, most models of industrialization proved incapable of creating a coherent national productive system which would enable those countries to decrease their degree of vulnerability in relation to world market fluctuations - a situation that is clearly shown in the present world economic crisis. Some of the models have also been unable to reduce the gap between developed and developing countries.

UNIDO's "Industry and Development. Global Report" of 1985 shows that the adverse impact of the crisis of the 1980s was more severe in those developing countries which had stronger trade and financial links with developed countries. The impact was also more severe on industrial branches, which were more dependent on foreign capital and markets.^{1/}

One of the main weaknesses of the models of industrialization in many developing countries seems to be due to the fact that they depend, to a great extent, on the economic growth of the developed countries to provide markets for greater industrial exports from developing countries. They also depend on increasing imports of capital goods and external financial resources needed mainly to meet their export targets.

In view of the results of industrialization in most developing countries, and of the world economic situation which has led most developed countries to establish barriers to imports as well as credit restrictions, the developing countries should promote policies for a more integrated development among the different sectors within their own

^{1/} UNIDO "Industry and Development. Global Report", ID/333, 1985, page 13

economy, as well as with other developing countries of the region. This strategy of development is most necessary and urgent in those industrial sectors where future growth is very much affected by restrictive measures, as is the case of the iron and steel industry.

Due to its role of supplying basic inputs to the main sectors of the economy, the iron and steel industry in developing countries can contribute to the creation of a coherent national and regional productive system. Consequently, the industrialization process in developing countries should account for all the possible links between the iron and steel industry and the other sectors of the economy, mainly the capital goods industries. The modality of this integration process will depend upon the specific structural characteristics of the different developing countries.

In this context, exports of iron and steel products from developing to developed countries should play a role, but should not be the main factor responsible for the development of the iron and steel industry in developing countries.

2. The links between the iron and steel and capital goods industries

Throughout history, in countries where the iron and steel industry played an important role in the process of industrialization, its development was mainly linked with the pace-setting sectors of the economy by providing them with their basic inputs. At the end of the eighteenth century, it provided the main inputs for the production of agricultural implements and, later on, for the manufacture of steam engines and equipment for manufacturing textiles and machine-tools.

During the nineteenth century, the massive construction of railroads generated an accelerated growth of the iron and steel industry. Between 1860 and 1880, significant technological developments took place in that industry (Bessemer, Siemens-Martin and Thomas steel-making processes), enabling it to meet the demands of different sectors of the economy such as shipbuilding, construction,

etc. During the twentieth century, the automobile industry generated another great push for growth and technological change in the iron and steel industry, which led to the development of giant blast furnaces, continuous casting, continuous rolling mills, etc.

Due to the important linkages between the iron and steel and the capital goods sectors, the main changes being introduced in the pace-setting industries (capital goods and consumer-durable industries) have a significant impact on the present situation and future possibilities of the iron and steel industry. In the capital goods industry changes are being introduced in technological processes requiring steels of higher performance and lower cost.

The trend towards the production of smaller and more fuel-efficient cars, which was initiated by the energy crisis, requires new types of steel - stronger and lighter (cold-rolled high strength steels with improved durability, etc.). Also a substitution of steel by other materials such as plastics, ceramics, etc. is taking place.

The important development of micro-electronics also has an impact on the iron and steel industry by strengthening the tendency to reduce the amount of iron and steel used per unit of output and by increasing the demand for higher quality steels. There is also a tendency to increase the use of high-speed steels in order to improve the performance of tools and machinery in general.

Advances in chemical-process technology and the growth of the chemical process industries require increasing amounts of stainless steel because of its high resistance to corrosion, weldability and formability. There is also a tendency to reduce the thickness of tubes by using materials of high creep rupture strength.

In the oil and gas industry, it is becoming increasingly difficult to develop economically the small fields that will provide oil and gas in the future. In order to overcome this problem, the oil and gas industry will need materials developed by the iron and steel industry that are more economical to use because they are lighter, as

well as materials able to withstand more severe environmental conditions for off-shore production, primarily in the Arctic regions.

In the agricultural sector, tractor-based mechanization is going through a severe economic crisis, with tractor sales down by 25 percent throughout the world. There is a trend in developing countries towards creating new types of less sophisticated agricultural machinery, implements and tools which can be produced in multi-purpose units, thus reducing the quantity and changing the composition of steel used.

There is also a tendency to provide cheaper steel products of a given quality, such as stainless steel with a lower nickel content which is easier to work, sheet steel for cans without tin (tin-free steel), silicon-free sheet for electric motors, etc.

3. The present situation of the iron and steel industry

The restructuring process taking place at the world-wide level has reduced total world demand for steel and, because of the increase in demand for high-grade and special steels in relation to other types of steel, it has altered the structure of the iron and steel industry.

General trends in the iron and steel industry are not reflected uniformly throughout different countries and regions. In developed countries, for example, the trend of specific steel consumption is decreasing, while in developing countries it is increasing.^{2/} In relation to overall steel consumption, the only countries experiencing positive growth rates are developing countries. The consumption of these countries grew from 96 million tons in 1980 to 100 million tons in 1984. However, the increases in production are also not uniformly distributed over the different regions. There is a decrease in the levels of production in Africa, the Middle East and generally in Latin

^{2/} Economic Commission for Europe "The Evolution of the specific consumption of steel", ECE/STEEL/45, United Nations, New York, 1984, page 112.

America, which is compensated by the increased production of the Asian region.

Amongst the developed countries, the United States has experienced the most serious crisis in the iron and steel industry with the level of consumption during 1984 close to that of 1960. The situation in the EEC is also difficult, with the production level of 1984 less than that of 1968. In Japan, the situation is slightly better; a small increase was achieved in production and consumption in 1984 in comparison to previous years; however, the level of production achieved in 1984 was about the same as that of 1973. In the COMECON countries, production and consumption continued to increase but at a very slow rate.

4. The evolution of relations between countries in the iron and steel industry

Over the last 29 years, the changes in patterns of development of the iron and steel industry have generated important modifications in the main flows of steel trade.

In 1955, the main aspects of balances of steel consumption and production were, inter alia, the large surplus of the EEC countries; the satisfaction of internal consumption by domestic production in the United States; a considerable deficit in developing countries; and a small deficit in USSR and Eastern Europe, taking it as a whole. In 1984, the most relevant aspects of consumption and production balances were the serious deficit in the United States and the significant increase in the surplus of Japan and the EEC countries. The deficit in developing countries continues to be very important; the Democratic People's Republic of Korea and China have increased their deficit in absolute terms; and the USSR and Eastern Europe have practically achieved a balance between consumption and production. In the table overleaf one can see the relation between consumption and production for these regions in 1955 and 1984.

World-wide development of the iron and steel industry has gradually increased the hegemony of Japan in this industry, increased considerably the production deficit of the United States, and has been unable to decrease the deficit of production in developing countries. Amongst the developing countries, Latin America is the only region showing a surplus in production.

Table 1. Balances of steel consumption and production
in 1955 and 1984
(million tons ingot equivalent)

	USA	EEC (10) Countries	Japan	Other Western Developed Countries	Western Developing Countries	China/ Dem. Rep. of Korea	USSR and Eastern European Countries
<u>1955</u>							
Consumption	102	62	7	21	16	4	58
Production	106	73	9	15	5	3	59
Balance	4	11	2	-6	-11	-1	1
<u>1984</u>							
Consumption	115.0	93.0	74.0	57.0	97.0	65.0	214.0
Production	84.5	120.2	105.5	61.1	74.09	49.85	213.9
Balance	-30.5	27.2	31.5	4.5	-22.91	-15.15	-0.1

Sources:

OECD "The Steel Market in 1980 and the Outlook for 1981";
IISI "Nineteenth Annual Meetings and Conference", London, UK, October 1985;
ECE "The Steel Market in 1984", United Nations, New York, 1985.

5. Future trends in the iron and steel industry

It has become apparent during the present decade that a few developing countries will be the pace setters in the growth of iron and steel production. In 1984, seven developing countries (five in Asia and two in Latin America) accounted for 87.5 per cent of the iron and steel production of developing countries, whereas in 1974 this figure was only 78.9 per cent. The five Asian countries alone contributed with

70 per cent of the additional production between 1974 and 1984. The estimated annual rate growth of consumption by developing countries for the period 1980 to 1985, made by the International Iron and Steel Institute, was 1.6 per cent. The figure for developed countries was estimated to be -1.3 per cent. For the period 1985 to 1995, the forecast rate of growth of consumption in developing countries will be even greater, 2.8 per cent. However, the consumption of developed countries will continue to decrease at an annual rate of 0.5 per cent.

The development of the iron and steel industry in developing countries in the present decade (1980s) is being characterized by some contradictory factors. They are experiencing higher rates of growth, mainly due to a few pace-setters, and there is a tendency to increased consumption of iron and steel. On the other hand, there are strong constraints to increase production capacity due to financial difficulties affecting many developing countries. As a result, many projects are being postponed, frozen or completely abandoned.

The growth in developing countries of consumption and financial constraints preventing increasing capacity, could result in a deficit of more than 30 million tons in 1990, and as much as 45 million tons if China and the Democratic Republic of Korea are included.

6. An integrated approach to the development of the iron and steel, capital goods, and agricultural machinery industries

Further processing of natural resources in producer countries has become an essential element in national development strategies. In the 1970s, the developing countries increased their share of global processed minerals, with Governments of developing countries playing an increasingly important role. However, the impact of a higher degree of iron ore processing in developing countries varies, depending on the strategy and model of development defined. The economic and social impact on a specific country will be different, according to whether the development strategy chosen considers mainly isolated export oriented projects or is oriented towards creating a coherent national productive system.

Developing countries, on the basis of a critical analysis of past experience in the development of their iron and steel industry and in order to reduce their important deficit of production in relation to consumption, should formulate new strategies and models of development which can contribute to the creation of a coherent national and regional productive system. In this context, the development of a more interrelated development between the iron and steel and the capital goods industries and other sectors of the economy, may constitute an important means to ensure a more integrated structure of development.

The process of planning the development of the iron and steel industry should take into consideration all possible links of iron and steel with other sectors, in order to better identify the modalities of integration in time to be adopted. There would be a greater possibility of using resources more rationally if, for example, the linkages of the iron and steel and the production of machinery and equipment were not considered in isolation, but together with the construction sector. Table 2 shows the dynamics of the relations between the iron and steel, capital goods and the construction sector.

Planning an integrated approach should also take into account the special conditions of the country in relation to their natural resources, level of production of iron and steel and capital goods, their interrelations, and the technological development already achieved.

The country studies developed by the UNIDO secretariat ^{3/} show that some developing countries have a relatively important production of iron and steel and capital goods; in these countries the relation

^{3/} For further details see: "Possibilities and modalities for an integrated development between the iron and steel industry and other sectors of the economy in Latin American countries", ID/WG.458/7; "Prospects of an integrated development of the iron and steel industry and capital goods: East and Southern African countries", ID/WG.458/8; "The integrated development between the iron and steel industry and the capital goods sectors: case studies", ID/WG.458/9. Background papers for the Fourth Consultation on the Iron and Steel Industry. Vienna, Austria, 9-13 June 1986.

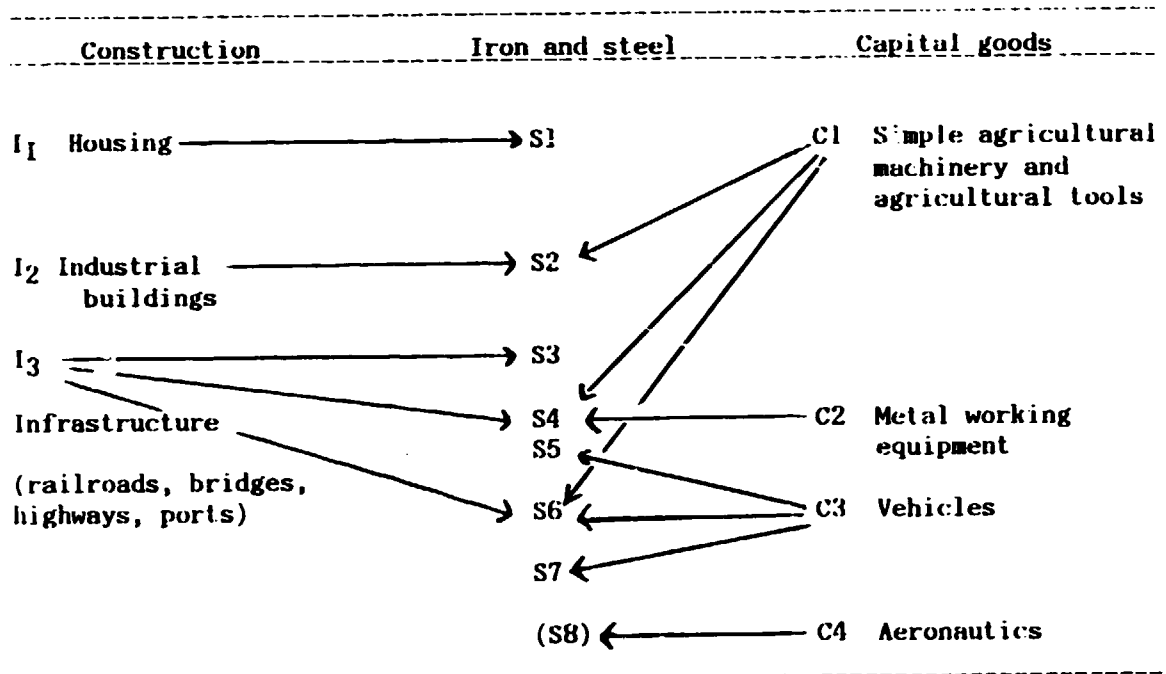
between them is stronger than the relation between the iron and steel industry and the construction sector. These studies also show that the technical level reached by these countries allows them to provide the iron and steel industry with spare parts and some equipment. There are some developing countries - Brazil, India, Republic of Korea - which can produce more than 40 per cent of the capital goods needed by their iron and steel industry. However, there are other countries where the iron and steel and the capital goods industries present a low degree of development. In these countries the relation of the iron and steel industry with the construction sector is stronger than with the capital goods industry. The relation with the capital goods industry is mainly limited to providing inputs for the manufacturing of simple agricultural machinery and tools and common purpose capital goods. The general lack of production of spare parts for the iron and steel industry increases the problems of maintenance of the iron and steel plants.

In the analysis of the different case-studies it was noted that industrial policies adopted had an important impact on the development of those industries and on their interrelations. Policies of indiscriminate liberalization of imports had negatively influenced the level of production in the iron and steel and capital goods industries and contributed to disintegrating the relations between those industries.

For those developing countries with a significant iron and steel industry, as well as a certain important basis of production of capital goods, further integration through provision of more complex steel inputs (high quality steels, etc.) could contribute to a major "push" in the development of machinery and equipment and of heavy infrastructure; it could also contribute to better utilization of resources. In addition, the production of more complex machinery and equipment could generate an important "pull" for the development of the iron and steel industry.

In small countries where agriculture is the main economic activity, development of iron and steel should be guided by the needs

Table 2. Relations between the products of the iron and steel industry and the capital goods and construction sectors



- S₁ Long products: reinforcing bars -- small diameters
- S₂ Long products: reinforcing bars, light and medium sections and light welded tubes
- S₃ Long products: heavy sections
- S₄ Hot rolled sheet iron, heavy welded tubes
- S₅ Cold rolled sheet iron, heavy sheets, galvanized sheets
- S₆ High quality steel and seamless tubes without welding
- S₇ Alloy steel
- S₈ Aluminium, titanium, magnesium alloys

for agricultural hand-tools, implements, equipment for the transformation of main crops, as well as for housing and small- and medium-size industrial buildings and other infrastructure and transport (railways) needs.

7. Co-operation for better use of resources in developing countries-----

From the studies developed by the UNIDO secretariat, and from discussions at expert group meetings, it has emerged that important possibilities of co-operation among developing countries have not been fully exploited. At present, co-operation at regional and subregional levels differs. ^{4/} Latin America and Asia have experienced an important advance in recent years, and Africa is beginning to develop co-operation at the regional level.

At present in Latin America, an ongoing complementary programme in the iron and steel industry, through a system of information of surpluses and deficits of production of the different countries, has been established by ILAFA. There is also a programme of co-operation in the field of transport which could generate important earnings for the region.

In the field of project development and technology, a project is being developed in Argentina (SIDERSUR) using Mexican direct reduction technology, and iron ore from Brazil.

^{4/} For further details see: "Possibilities and modalities for an integrated development between the iron and steel industry and other sectors of the economy in Latin American countries", ID/WG.458/6; "Prospects of an integrated development of the iron and steel industry and capital goods: East and Southern African countries", ID/WG.458/8; Background papers for the Fourth Consultation on the Iron and Steel Industry. Vienna, Austria, 9-13 June 1986. Report on the Ad-Hoc Expert Group Meeting on Strategies for more Integrated Development between the Iron and Steel and Capital Goods Sectors, Vienna, Austria, 16-18 October 1985, UNIDO/PC.127. Report on the Expert Group Meeting on the Preparation of Guidelines for the Establishment of Mini-Plants on Iron and Steel with Special Emphasis on Africa, Vienna, Austria, 1-5 December 1985, UNIDO/PC.132

However, in Latin America there are still possibilities of co-operation for increasing the exchange of raw materials, semi-finished, and finished products which could lead to better utilization of the actual installed capacity. For example, there are important reserves of coking coal in Colombia and of high-grade iron ore in Brazil, Venezuela and Chile that could be used in the region. In addition, the excess production capacity of direct reduction sponge iron (Venezuela, Mexico), of hot- and cold rolled flat products, and of special steel (Mexico, Venezuela, Brazil) could be used to satisfy the needs of other countries in the region.

In Africa, co-operation is very limited. However, there is an important programme to rationalize the existing iron and steel plants of the East and South African countries as well as to replace imported inputs, mainly scrap, in order to avoid unnecessary duplication of production that could lead to a better utilization of installed capacity.

There are still many important possibilities of co-operation in Africa in the fields of training and in transport - mainly railways. Emphasis should be placed on increasing the co operation regarding the supply of spare parts for the iron and steel plants between Africa and other developing regions that are already producing them.

During the last few years, co-operation between Asian countries has increased. For example, Singapore is providing Malaysia and Indonesia with pipes and other steel products for extraction work in the development of petroleum and natural gas, etc. However, this co-operation between the Asian countries still has a long way to go. Co-operation could be increased in the region by complementing each others needs for raw materials (iron ore, natural gas), for the production of ingots and flat products.

8. Final considerations

An important restructuring process is taking place at the world wide level in the iron and steel industry, and this is caused by several factors. One of the main causes is the process of internationalization of iron and steel production which makes national iron and steel industries vulnerable to the fluctuations of the world market.^{5/} Structural changes in the capital goods industries, which are the principal users of iron and steel, have also affected the level, structure and quality of iron and steel production.

The restructuring process has tended to change the main flows of steel trade and has located the centre of growth in a small group of developing countries. However, the dominant logic of world-wide development of the iron and steel industry and the important financial constraints which many developing countries are suffering, have not permitted a significant reduction in the production deficit in developing countries which will continue to be relatively high in the 1980s.

Developing countries, in order to reduce their vulnerability and to profit from the growth of their iron and steel industry, should promote a more integrated development of the iron and steel industry with other sectors of the economy. Therefore iron and steel has to be developed in the framework of achieving a more coherent national and regional productive systems.

In order to adequately identify the constraints, possibilities, and advantages for developing an integrated approach between the iron and steel and the capital goods and agricultural machinery industries, it would be necessary to focus the discussions on the following:

.....
^{5/} The proportion of iron and steel production exchanged on the world market rose from 10.7 per cent in 1950 to 23.7 per cent in 1974 and to approximately 30 per cent at present.

1. Analysis of the past and possible future main trends in the development of the iron and steel industry in the 1980s: Special attention should be given to the impact of this development in developing countries;

2. Possibilities of promoting in developing countries a more integrated development of the iron and steel industry with other sectors of the economy, especially with capital goods and agricultural machinery. It should be analysed at the global level and in different regions, and in some subregions considered as special cases;

3. Possible models of an integrated approach for the development of the iron and steel industry and other sectors of the economy, with special emphasis on countries with little or medium industrial development, and newcomers to the industry;

4. Main aspects and measures to be considered in planning and implementing the integrated development of the iron and steel with capital goods industries and other sectors of the economy;

5. Possible forms of international co-operation between developed and developing countries and among developing countries themselves to further the development of the iron and steel industry in developing countries.