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THE DEVELOPMENT OF THE BRAZILIAN IRON AND STEEL INDUSTRY[1/]

by

the Secretariat of CONSIDER
Brazil

1/ The views and opinions expressed in this paper are those of the authors and do not necessarily reflect the views of the secretariat of UNIDO.

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1. FOREWORD

1.1 Historical background

1597 - Beginning of Brazil's iron and steel activities in the neighbourhood of São Paulo with the construction of a small Catalan forge.

1630 - With the object of protecting her own industry, Portugal forbids Brazil to carry out iron and steel activities.

1785 - As a result of Brazil's resumption of iron and steel making, as well as the arrival of German, Swedish, and French technicians, the sector is reorganized; thus, the construction of the first blast furnaces in São Paulo and Minas Gerais takes place.

1879 - Establishment of methods for exploiting country's mineral resources, along with the training by the Minas de Ouro Preto School of the first Brazilian technicians.

1888 - Beginning of construction of the oldest furnace still in operation, at Itabirito, Minas Gerais.

1909 - With two blast-furnaces and 100 small forges in operation, production was around 2,100 tons/year of pig-iron and 2,000 tons/year of iron bars. At that time, imports rose to an annual rate of 270,000 tons/year. Discovery of large iron-ore deposits in the State of Minas Gerais.

1917 - Foundation of Cia. Siderúrgica Mineira, which later became associated with the Belgian-Luxembourg group, ARBED, thus creating the Companhia Siderúrgica Belgo-Mineira.

17/1940 - Several enterprises were established which raised the production level to 140,000 tons/year of steel ingots.

1941 - Foundation of Cia. Siderúrgica Nacional (CSN), with an initial estimated capacity of 270,000 tons/year. CSN started operations in 1946.

COSIPA and USIMINAS were founded in the 1950s, both having come into operation by the middle of the last decade.

At the present time, the Brazilian steel industry, through 34 main enterprises, has an installed capacity of 8 million tons/year of steel ingots. In 1972, the production was raised to 6,518,000 tons. For 1973, an overall production of 7,200,000 tons is estimated.

1.2 Brazil's position in relation to other countries

In 1972, with a production of 6.4 million tons of steel ingots, Brazil ranked first in Latin America, the production of which corresponded to 42.5% in the overall sector, having reached 15.3 million tons.

With regard to world steel production, which reached 627 million tons, Brazil ranked in 17th place, with 1.04% of the world production.

2. STRUCTURE OF THE BRAZILIAN STEEL INDUSTRY

2.1 The sector enterprises

Taking into account steel manufacturing enterprises alone, disregarding those producing less than 25,000 tons/year of ingots, 34 enterprises with installed capacity of 8,055,000 tons/year comprise the Brazilian steel industry, which for 1973 may be broken down as follows:

(a) According to degree of integration

	No. of Enterprises	Installed Capacity 1,000t/year	%
1. Coke integrated	3	3,900	48.4
2. Charcoal integrated	8	1,645	20.4
3. Charcoal and electric-furnace reduction integrated	2	755	9.4
4. Direct-reduction integrated	2	150	1.9
5. Semi-integrated	19	1,605	19.9

(b) According to steel-making process

	No. of Enterprises	Installed Capacity 1,000 t/year	%
1. LD converters	6	3,140	39.0
2. Electric furnaces	22	2,070	25.7
3. Open-hearth furnaces	12	2,845	35.3

(c) According to capacity

Steel ingot capacity, t/year	No. of enterprises	Installed Capacity 1,000t/year	%
1. Up to 100,000	16	725	9.0
2. Between 100,000 and 500,000	14	2,780	34.5
3. Between 500,000 and 1,000,000	1	650	8.1
4. Over 1,000,000	3	3,900	48.4

Besides the 34 enterprises mentioned above, there still exist in Brasil three of 30,000, 60,000 and 80,000 tons/year installed capacity, as well as a number of small rerollers for both flat and non-flat products.

It should also be pointed out that around 60 enterprises operate almost 90 charcoal blast furnaces, with pig-iron production capacity of the order of 1,200,000 tons/year.

The needs of all Brazilian foundries are met by these blast furnaces, which fulfil steel plants' needs and still export a significant proportion of their production.

2.2 Official support for the steel industry

Overall planning of the Brazilian steel industry is in the hands of CONSIDER (the National Council for the Iron and Steel Industry), an inter-ministerial body controlled by the Ministry of Industry and Commerce, under the aegis of the Finance, Planning, and Mines and Energy Ministers, as well as the Presidents of the Bank of Brasil, the National Bank for Economic Development, and the Brazilian Institute for the Iron and Steel Industry. CONSIDER functions as the Executive Secretariat of the Ministry of Industry and Commerce.

CONSIDER is also responsible for granting fiscal incentives relating to the establishment and expansion of iron and steel plants in the following ways:

(a) import tax exemption on industrial products and equipment with no national equivalent;

(b) credit for industrial products from national suppliers;

(c) authorization to apply accelerating depreciation to plant supplied by national manufacturers.

In addition, projects approved by CONSIDER receive priority from Brazilian official banks in securing financial support.

3. ECONOMIC ASPECTS

3.1 The Brazilian steel market

3.1.1 Development in the period 1961-1972

(a) Brazilian Steel Production, 1961-1972

1,000 tons

Year	ROLLED PRODUCTS			Ingots
	Flat	Non-Flat	Total	
1961	834	974	1,808	2,443
1962	910	1,072	1,982	2,565
1963	1,029	1,070	2,099	2,824
1964	1,010	1,226	2,236	3,016
1965	1,119	1,119	2,238	2,983
1966	1,379	1,320	2,699	3,782
1967	1,334	1,446	2,780	3,734
1968	1,779	1,705	3,484	4,453
1969	1,909	1,992	3,901	4,924
1970	1,937	2,241	4,178	5,390
1971	2,301	2,434	4,735	5,997
1972	2,612	2,702	5,314	6,518

As can be seen, Brazilian steel production in the period 1961-1972 increased at a rate of 9.4%, almost trebling in the period, and the average growth rate between 1967 and 1972 was 11.8%.

(1) Brazilian Steel Imports, 1961-1972

Year	Flat Rolled Products		Semi-finished Products		Total Rolled Products	
	Quantity, 1000 t	Value, million US $	Quantity, 1000 t	Value, million US $	Quantity, 1000 t	Value, million US $
1961	166	45.0	164	41.2	330	86.2
1962	142	33.8	134	32.6	276	66.4
1963	190	60.3	200	45.6	390	105.9
1964	134	31.8	163	33.0	297	64.8
1965	124	28.5	136	27.7	260	56.2
1966	177	41.0	137	33.4	314	74.4
1967	161	41.0	176	39.1	337	80.1
1968	189	46.1	164	37.3	353	83.4
1969	231	61.3	240	47.4	471	108.7
1970	316	91.1	271	63.5	587	154.6
1971	706	138.1	504	102.5	1,210	240.6
1972	702	149.7	352	101.3	1,054	251.0

Worthy of note is the high rise in imports in 1971, due to growing demand, inadequacy of internal output, and favourable international prices, which led to the formation of large stocks.

From 1971, Brazil started importing large amounts of semi-finished products to make use of under-utilized internal rolling capacity.

(c) Brazilian Steel Exports, 1961-1972

Year	Flat Rolled Products		Non-Flat Rolled Products		Total Rolled Products	
	Quantity, 1000 t	Value, million US $	Quantity, 1000 t	Value, million US $	Quantity, 1000 t	Value, million US $
1961	-	0.1	3	0.3	3	0.4
1962	-	0.1	1	0.1	1	0.2
1963	-	0.2	-	-	-	0.2
1964	64	7.2	17	1.9	81	9.1
1965	245	26.0	110	10.8	355	36.8
1966	99	11.5	39	5.0	138	16.5
1967	306	29.1	35	3.8	341	32.9
1968	272	23.1	33	2.8	305	25.9
1969	254	28.3	70	7.9	324	36.2
1970	224	38.7	350	42.0	574	80.7
1971	148	18.4	114	15.3	262	33.7
1972(*)	197	26.2	152	19.4	349	45.6

* January-November figures

Up to 1967 exports were primarily a means for disposing of home production surpluses: at that time, mainly semi-finished and flat rolled products were exported. From 1968, with the Government policy of export incentives, the iron and steel sector was able to intervene effectively in competition on the world steel market.

(d) Apparent Consumption of Steel in Brazil, 1961-1972 (1000 t)

Year	ROLLED PRODUCTS			Equivalent Ingots
	Flat	Non-Flat	Total	
1961	1,000	1,130	2,130	2,861
1962	1,052	1,205	2,257	2,941
1963	1,319	1,270	2,589	3,480
1964	1,080	1,372	2,452	3,367
1965	998	1,145	2,143	2,913
1966	1,457	1,418	2,875	4,061
1967	1,189	1,587	2,776	3,763
1968	1,696	1,836	3,532	4,566
1969	1,886	2,163	4,049	5,144
1970	2,163	2,163	4,191	5,488
1971	2,710	2,726	5,436	7,280
1972	2,826	2,782	5,608	7,286

As can be seen, up to 1967 Brazilian apparent consumption was irregular, and then grew consistently, giving for the 1967/72 period an average rate of 14.1%.

Development of Brazil's Effective Steel Consumption, 1969-1972 (1000 t)

Year	ROLLED PRODUCTS			Equivalent Ingots
	Flat	Non-Flat	Total	
1969	1,784	1,903	3,687	4,925
1970	2,117	2,144	4,261	5,695
1971	2,459	2,462	4,921	6,583
1972	2,888	2,836	5,724	7,636

3.1.2 Future Development

Through the application of technical co-efficients to production estimates in the various sectors, Brazilian steel consumption forecasts have been made up to 1980.

Forecast of Brazilian Rolled Product Consumption, 1973-1980 (1000 t)

Products	1973		1975		1980	
	Rolled Products	Equivalent Ingots	Rolled Products	Equivalent Ingots	Rolled Products	Equivalent Ingots
1. Semi-finished	88.5	91.4	106.5	110.3	158.0	163.7
2. Flat-rolled	3,272.3	4,695.3	4,269.9	6,117.5	7,425.0	10,630.6
- Uncoated	2,649.9	3,817.3	3,428.1	4,809.1	6,056.2	8,507.0
- Coated	525.3	808.9	697.3	1,073.8	1,126.4	1,734.7
- Special	104.8	168.6	145.8	234.6	242.4	388.9
3. Non-flat Rolled	3,100.9	3,848.1	3,902.3	4,841.5	7,081.0	8,789.7
- Light Common	2,004.0	2,429.4	4,514.5	3,024.6	4,525.1	5,485.0
- Medium and Heavy Common	413.5	529.2	463.0	592.6	887.0	1,135.2
- Uncommon	470.4	602.0	628.5	796.7	1,164.4	1,490.4
- Seamless Tubes	213.0	287.7	272.3	367.6	504.5	681.1
T O T A L	6,468.5	8,634.8	8,278.7	11,069.3	14,664 0	19,584.0

The above figures indicate an expected overall growth rate of 13.1% in the period 1973-1975, with 9.9% for semi-products, 14.1% for flat rolled products, 12.1% for non-flat rolled products, and of 12.1% in the period 1975-1980, with 8.2% for semi-products, 11.7% for flat products and 12.6% for non-flat products.

3.1.3 Distribution by Sectors of Consumption for 1975

So far as steel consumption sectoral distribution is concerned, surveys demonstrate that this will vary slightly up to 1980. The estimated sectoral distribution for 1975, which is adequate in this respect to visualise Brazilian steel consumption, is given below.

[illegible]	[illegible]	Flat Rolled Products	Non-Flat Rolled Products	Total
1. Transportation	-	24,3	9,9	16,7
2. Components and Parts	[illegible]	[illegible]	12,7	10,1
3. Road and Agricultural Machinery	-	5,7	1,6	2,6
4. Mechanical Industrial Equipment	12,4	9,7	4,8	7,5
5. Electrical Plant and Equipment	[illegible]	[illegible]	0,4	1,7
6. Domestic and Commercial Utilities	-	[illegible]	0,3	4,2
7. Sundry	-	0,6	1,1	0,8
8. Packaging	-	1,1	0,1	9,9
9. Civil Construction	7,5	8,0	46,2	26,5
10. Wire-drawing	-	-	22,8	10,8
11. Others	-	15,5	1,1	8,6
T O T A L	[illegible]	100,0	100,0	100,0

It can be seen that the civil construction sector is the largest steel consumer, with 26.5%. Taking into account, however, that components and parts are fundamentally destined for the transportation sector, this is in fact the largest steel consumer in Brazil. This sector comprises the automotive, shipbuilding, railway, aeronautical, bicycle, and motor-cycle industries.

3.2 Costs and prices

a) Costs - In Brazil there are plenty of high-quality raw materials (with the exception of fossil fuels), as well as plentiful and cheap manpower, the basic requirements for low-cost steel production. In addition, Brazil has always suffered from a lack of capital which, combined with the inflationary process and the low production scales, caused steel costs to be normally high until the 1960s.

Hence, despite inflationary tax reductions and in terms of production scales, in general financial costs still represent a substantial cost fraction, proportionately higher than in the most industrialized countries.

In Brazil overall costs, however, are kept on a descending curve, at the present time, for a series of products, retaining competitive levels in world market.

b) Prices - Current prices of most products are lower than those on the internal markets of the industrialised countries, although they are always normally higher than those on the world market.

Brazil's tariff laws protect Brazilian products with 37% average duty on ordinary steels and 45% on special steels, together with exceptional protection measures of temporary application, for products clearly traded in a dumping regime on the world market.

3.3 Brazil at the World Steel Market

Although Brazil's export share of world trade, of less than 1%, is insignificant, these exports are easy to carry out, and will become larger in the coming years, when the Brazilian iron and steel industry will be working at a high rate, taking advantage of the increasing economies.

On the other hand, it may be observed that production costs in industrialized countries are rising as a result of the adoption of severe anti-pollution measures, increasing wages, and distortions due to inflation, which will certainly increase the competitiveness of Brazilian products.

For this reason, the Brazilian government has decided to devote 10% of the country's installed capacity to production for export, as well as negotiating the establishment of plants exclusively for this purpose.

4. TECHNOLOGICAL ASPECTS

4.1 Processes used in Brazil

Despite its relatively small size, the Brazilian steel industry has closely followed world developments in steel technology, absorbing all the innovations in the field of production and control.

4.1.1 Raw-materials preparation

The raw-materials yards of the most recent integrated plants are entirely mechanized, using stackers, reclaimers, and conveyor belts for stocking and reclaiming.

In general, for the utilization of ore and coal fines, Brazilian plants employ sintering. This includes USIMINAS, which since its establishment has aimed at the use of sinter as a basic component for its blast furnace burdens.

The internal consumption of pellets is still very small. The only producing enterprise, working basically for export, is Cia. Vale do Rio Doce, with an output of 5 million tons/year.

Scrap is almost entirely traded in a crude form, i.e. with a low level of preparation. For this reason, most of the enterprises are equipped with scrap presses and preparation facilities.

4.1.2 Coking

The three Brazilian enterprises have, since their establishment, been equipped with classical coke-oven plants and by-product recovery installations.

4.1.3 Reduction

Charcoal reduction, in use since the beginning of the last century, has been highly developed in Brazil; it is principally concentrated in the State of Minas Gerais. Charcoal blast furnaces capacities in Brasil vary between 20 and 500 tons/day; the degree of technological development varies equally widely. The current production capacity is 3 million tons/year.

The blast furnace, introduced into Brazil in 1[illegible], is represented by five units which vary in capacity from [illegible] to 2,000 tons/day. The three enterprises equipped with these furnaces are at present in the process of installing new 3,000 and 2,500 tons/day furnaces, which will start operation by 1974 and 1975.

Since the electric reduction process is not competitive with the blast furnace, it has not developed in Brazil. There are only recorded two Tyckland-Hole furnaces in operation, one at Mannesmann and another at Acesita.

There are two plants in Brazil that are starting up direct reduction processes. Piratini has adopted the SL/RN process, designed to utilize the coals available at the plant site, whilst USIBA has adopted the H/L process, using natural gas from near the plant. Their nominal output capacities of sponge iron are, respectively, 66 and 180 thousand tons/year.

4.1.4 Steel-making

Thirteen enterprises in Brazil use the open-hearth process, with an overall steel capacity of 2,850,000 tons/year. There are eight 200 ton furnaces at CSN, and the remainder vary in capacity from 15 to 60 tons.

The LD process was introduced into Brazil soon after it was invented, and at present seven enterprises are using it, with a total of 3,100,000 tons/year installed capacity. The converters in use vary in capacity between 18 and 80 tons.

Since it requires less investment, the electric arc steel-making process is the most commonly used by small enterprises, with installed capacity totalling 2,100,000 tons/year. Most of these furnaces vary in size between 10 and 40 tons, with the exception of the units of COSIGUA and USIBA which are, respectively, of 70 and 100 tons.

4.1.5 Refining steel

(a) Vacuum degassing

This process was introduced in Brazil by Aços Villares, who manufacture special steels, through the acquisition of a 25 tons ASEA-SKF furnace. The same process is now being installed at Aços Arbanguera and Açes Finos Piratini.

(b) Electro-slag refining

This process is being installed by Eletro-Metal for the production of high-alloy tool steels and highly resistant steels for the aeronautics industry.

(c) Vacuum induction

This is in use by a small concern in São Paulo for the manufacturing of alloys, with high technological requirements.

4.1.6 Continuous castings

In 1961 Siderúrgica Riograndense installed this process, beginning with a 2-strand Böhler vertical machine, for 100 x 100 mm billets.

At present, there are several other enterprises using this process, and all the plans for establishing new plants provide for the use of continuous casting.

4.1.7 Rolling

Brazil's experience in rolling is very wide, owing to the high degree of diversification of the plants and mills in order to meet local needs.

- Uncoated flats: Brazilian production is concentrated at three plants - CSN, USIMINAS, and COSIPA.
- Coated flats: the only Brazilian manufacturing enterprise for this type of rolled product is CSN, which has two continuous electrolytic lines with a tin-plate capacity of 300,000 tons/year and has started operation with a 150,000 tons/year continuous galvanising line. It also has facilities for hot-dip galvanising and terne plate production.

- Special flats: [illegible] sheets are manufactured by ACESITA.

- Rails and heavy sections: Manufactured only by CSN.

- Ordinary grade non-flats: There are around 24 enterprises engaged in this type of production, most of them working with cross-country discontinuous units. It is worth mentioning that Belgo-Mineira has a modern 3-strand Morgan continuous mill.

- Special non-flats: This sector involves seven enterprises which virtually produce, both from the chemical composition viewpoint and that of shape, gauge, and degree of finishing treatment, all the specifications required by a modern engineering industry. Aços Villares and Aparecida both possess 2,000 ton presses for forging blooms and shafts.

- Seamless tubes: these are manufactured by Mannesmann and Cosim, notably the former, which produces tubes up to $10^3/_4$ in.

4.1.8 Other flat products

- Welded shapes: CSN and USIMINAS have manufacturing plants for large welded components for bridges and large structure. In addition, there are a number of enterprises linked with the civil engineering industry which have similar facilities.

- Welded tubes: twenty manufacturing plants linked with the steel sector, in addition to Mannesmann, produce welded tubes.

4.2 Manufacturing in Brasil

4.2.1 Flat products

So far as uncoated flat products are concerned, Brasil produces plates with a maximum width of 2,750 mm, as well as hot and cold coils and sheets with a maximum width of 1,575 mm, and a maximum coil weight of 10 tons. These rolled products are manufactured in accordance with ASTM, DIN, and API standards, and can also be produced to meet special requirements.

In the coated flat product field, tinplate, galvanized sheet and terne plate are manufactured. Tinplate is standardized in the 0,22 to 0,38 mm ranges.

So far as special steel sheets are concerned, only non-grain-oriented silicon-steel sheets are manufactured in Brazil, together with a small amount of alloy-steel sheets. Production of grain-oriented magnetic sheets and stainless steel sheets is expected to start in 1975.

4.2.2 Ordinary-grade non-flat products

All types of ordinary-grade non-flat rolled products are produced - reinforcing bars, wire rod, flat, round, square, and hexagonal bars, rails, and light and medium sections, and even special shapes, such as those for heavy vehicle wheels.

4.2.3 Special non-flat products

In general terms, all the carbon and low- and high-alloy AISI-SAE steel series are produced in Brazil, in the shapes, sizes, tolerances, and degrees of finishing required by the engineering industry.

4.2.4 Seamless steel tubes

Rolled seamless and hot-extruded tubes, as well as cold-drawn alloy steel tubes, are produced. The maximum size is $10^3/_4$ in., at which size spiral and submerged-arc welded tubes are produced.

4.2.5 Centrifugal-cast pipes

Water and sewage pipes are produced in Brazil in various sizes, up to a maximum diameter of 800 mm. Presently, nearly all production is of nodular iron.

4.3 Project Planning and Engineering

For consultancy services for economic and feasibility studies, Brazil has a number of enterprises, some of which are highly experienced in the steel sector and have recently carried out all the surveys that the country has made

For project engineering [illegible] with [illegible] plant., as well as those which use complicated processes, Brazil still has to resort to specialized enterprises from abroad. Regarding project design, there are a great deal of planning firms which normally meet all these needs. Civil construction and equipment assembly are likewise carried out by Brazilian enterprises, no matter how large the plant.

4.4 National Plant Manufacturers

The Brazilian plant manufacturing industry has already achieved a high degree of respect and sophistication, handicapped only by difficulties relating to scale of production.

In practice, the industry can produce most of the equipment needed for ordinary-grade rolled products up to around 400,000 tons/year capacity, electric furnaces up to 40 tons capacity, charcoal blast furnaces of any size, small coke blast furnaces and ancillary and complementing equipments.

5. RAW MATERIALS

Brasil is well provided with the mineral resources utilized in the steel sector, with the exception of fossil fuels.

5.1 Coal

There are coking coal deposits in the south of the country (State of Santa Catarina), with estimated reserves of 1,200 million tons.

The average ash and pyrite contents of the coal as-mined are, respectively, 30% and 8%. Only one-third of this is selected for use, after washing, in the steel plants, with 18.5% ash and 1.7% sulphur.

The national coal is blended with imported high- and low-volatile coals, to the extent of 40%; it is planned to decrease this to 20%.

There are in the States of Rio Grande do Sul and Paraná non-coking coal deposits with high ash contents, the reserves of which amount to 2,060 million tons. The Rio Grande do Sul coal is being beneficiated for utilization by Aços Finos Piratini in the SL/RN direct-reduction process, for the production of 65,000 tons of sponge iron per year.

5.2 Natural gas

This occurs in commercial quantities in Aratu (State of Bahia), where USIBA is located. This plant utilizes the HyL direct-reduction process in a 130,000 tons/year capacity installation.

5.3 Charcoal

In 1972 charcoal consumption was around 8,900,000 m^3 in nearly 100 blast furnaces, for the production of 2,500,000 tons of pig-iron, which represents 48% of the country's total production.

Exploitation of natural reserves is still feasible, and there is a compulsory reafforestation policy. However, thie source must be considered as a limited one and, with rising costs, the application of timber must be upgraded and its price raised.

5.4 Iron ores

High-grade iron ore reserves are known in almost all the Brazilian States; the major ones are the ferriferrous quadrilateral ore deposits from Minas Gerais and those of Serra dos Carajás, recently discovered in the north of Brasil.

The reserves with over 60% iron content at present being exploited reach 4,700 million tons measured, 3,700 million tons indicated, and 3,000 million tons inferred.

In 1972, Brasil's iron ore exports amounted to 32 million tons out of a total output of 41 million tons.

5.5 Scrap

The Brazilian steel industry is at present heavily dependent on scrap which, in 1972, represented 41% of the metallic charge, i.e. around 3 million tons.

5.6 Limestone

Limestone is abundant and widely spread over Brazil, with estimated reserves of 5,200 million measured tons, 3,100 million indicated tons, and 3,000 million inferred tons.

5.7 Manganese ore

The reserves being exploited are estimated at 40.5 million measured tons, 14.2 million indicated tons, and 24.2 million inferred tons of ores with 30% manganese minimum contents.

5.8 Dolomite

Brasil's exploited reserves are estimated to be 94.2 million measured tons, 43.6 million indicated tons, and 38.5 million inferred tons. The major reserves are located in Minas Gerais and São Paulo.

5.9 Magnesite

Brasil's reserves under exploitation reach 111.4 million measured tons, 190 million indicated tons, and 291.1 million inferred tons with MgO contents of 45% and above.

5.10 Fluorite

Although it occurs elsewhere, the only exploited reserves of fluorite are found in the State of Santa Catarina, with 459,000 measured tons, 213,000 indicated tons, and 314,000 inferred tons of ore with 8% CaF_2.

5.11 Ferro-Alloys

Brazil is self-sufficient in ferro-alloys, except low-carbon alloys, which are in part imported.

Brazilian ferronickel output is absorbed 30% by the domestic market and 70% by export. Ferroniobium output is almost wholly exported, Brasil's supply covering around 90% of the world consumption.

5.12 Refractories

There are numerous ores to meet the requirements of the refractories industry, which is centred in four large concerns (with some other smaller ones). The industry can meet the requirements of the national steel market with a high degree of international technological backing.

5.13 Other materials

In general terms, all the other materials the steel industry utilises are either manufactured or available in Brazil, except a few relatively unimportant items, such as zinc, some brands of welding electrodes, etc.

6. NATIONAL STEEL PROGRAMME

Until 1970, the steel sector was not subject to any special attention on the part of the Government, its planning being included in the broad industrial programmes.

Starting in 1970, CONSIDER (the National Council for the Iron and Steel Industry) was reorganised as a decision-making official organism. It is specifically orientated towards Brasil's steel sector, with a broad remit for the formulation, follow-up, and control of the industry's policy.

In connexion with these responsibilities, CONSIDER has laid down the following guidelines for the National Steel Programme:

(a) Expansion of capacity to meet domestic demand with 10% of the production for export and the maintenance of 10% operational reserve;

(b) Creation of manufacturing units that in design and size are very modern in terms of technological processes;

(c) Top-priority major expansion of the government-owned flat-products plants to be carried out;

(d) Provision of incentives for the expansion and establishment of non-flat products plants, through private initiative, in accordance with basic parameters set up by CONSIDER (Resolution 15);

(e) Elaboration of action planning throughout the sectors on which the steel industry depends, such as personnel, transportation, ore, refractories, technology, standards, data handling, etc.

(f) Follow-up by Government agencies in connexion with suitable pricing and fiscal policies, bearing in mind the carrying out of established plans.

Market studies carried out in 1970 defined for 1980 a domestic consumption of 16 million tons of equivalent ingots.

For the flat products sector, the following programme has been set up:

Capacity (1,000 tons)

Enterprises	Present	1976/77	1980
CSN	1,700	2,500	4,000
COSIPA	1,000	2,300	3,500
TOTAL	[illegible]	[illegible]	11,000

The total cost of projects completed or due for completion by 1976/77 is US$ 1,660 million, of which US$ [illegible] million is in foreign currency.

[illegible] emphasis being [illegible], as [illegible] the World Bank (IBRD) with US$ 122 million and [illegible] with US$ [illegible].

The remaining needs are to a[illegible] covered by stand-by credits from most of the [illegible] for [illegible] equipment.

During the last three years the performance of the Brazilian economy has exceeded all the forecasts and, in 1972, as a result of forecasts of 20 million ing t[illegible] demand [illegible], a new study was made. The expansion programme will therefore be revised.

For incentive purposes, the ordinary-grade steel non-flat products sector already had eight expansion projects approved; the establishment of a large plant based on the [illegible] is being studied.

The special steels sector has already received fiscal incentives for two expansion projects.

The 1972 market forecasts and the basic predicted requirements for installed capacity give the following requirements:

	Million tons of Equivalent Ingots
Flat rolled products	13.6
Non-flat rolled products	8.6
Special steels and seamless tubes	2.8
Total	25.0

Negotiations about the establishment of an integrated works producing 3 - 6 million tons of semi-products, mainly destined for export, are in progress between international and national groups and the Ministry for Industry and Commerce, through the CONSIDER Secretariat.

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