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on the Iron and Steel Industry

Moscow, USSR, 19 September - 9 October 1968

A-6

PRESENT STATUS AND FUTURE OF THE IRON AND STEEL INDUSTRY OF THE LATIN AMERICAN COUNTRIES 1/

by

R. Suarez

ECLA

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PRESENT STATUS AND FUTURE PROSPECTS OF THE IRON AND STEEL INDUSTRY IN THE LATIN AMERICAN COUNTRIES[1/]

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R. Suarez

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SUMMARY

The paper describes the growth in apparent consumption of rolled steel products in the Latin American countries during the period 1955-1965, estimates the possible demand for these products in 1970, 1975 and 1980, and outlines the plans of steel enterprises for expansion. The document indicates that over the ten years reviewed the steel production growth rate averaged 12.7 per cent annually, and it mentions some of the changes that have taken place in the structure of the industry. It contains an analysis of installed capacity in integrated plants and of prospects for more effective utilization through the intensified application of advanced techniques.

With respect to raw materials, mention is made of the abundance of high-grade iron ores in the region, and of the fact that the same does not apply to coking coal, which most integrated plants are obliged to import for mixing with locally mined coal.

The document also deals with intra-regional trade in rolled steel, and concludes with some information on the capital structure of integrated iron and steel enterprises and the sources of their principal foreign credits.

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* This is a summary of a paper issued under the same title as ID/WG.14/42.

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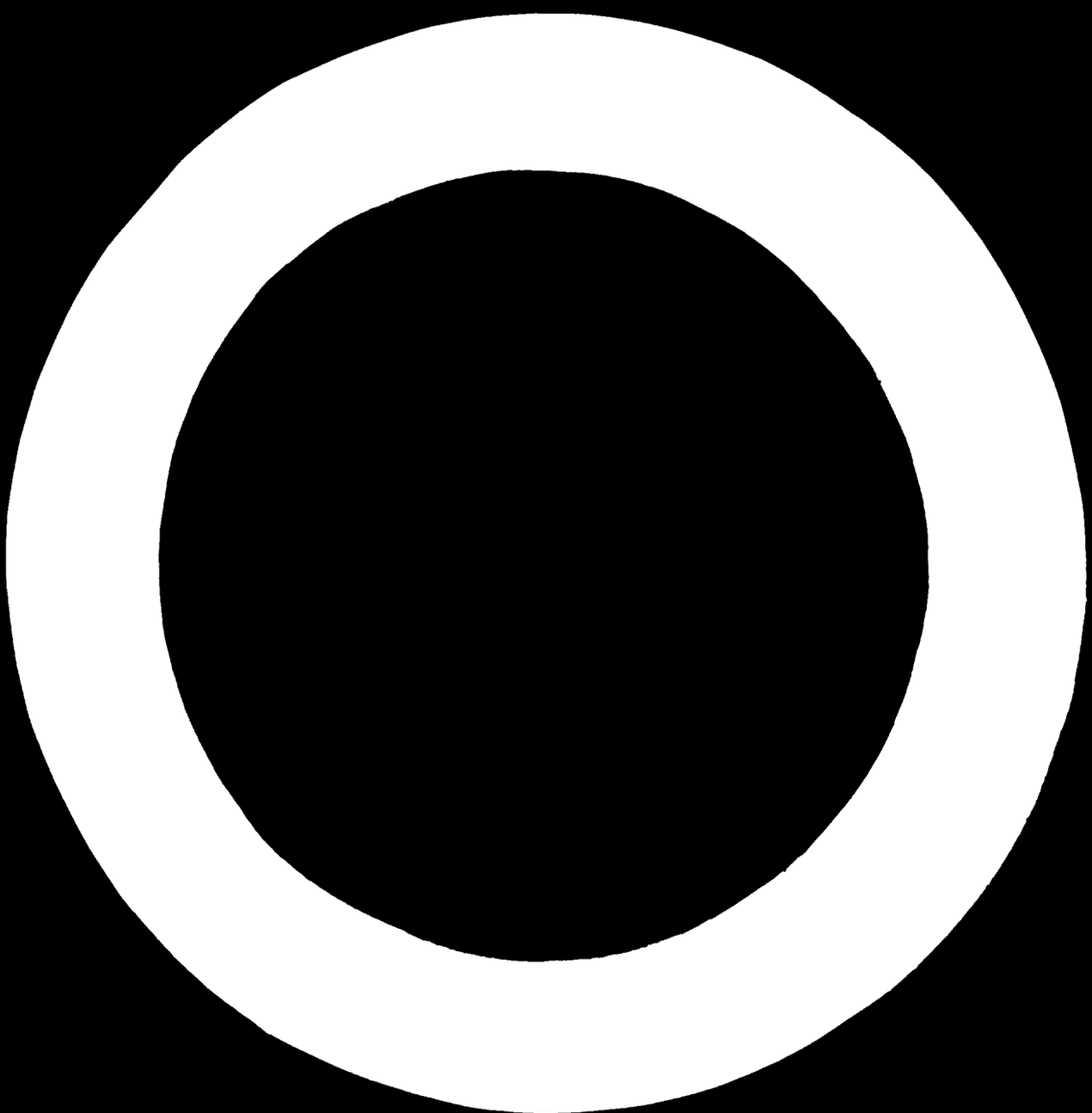

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I. APPARENT CONSUMPTION OF ROLLED STEEL PRODUCTS

1. Past consumption

In Latin Amerioa as a whole the apparent consumption of rolled steel products, expressed in terms of the ingot equivalent[1/] rose from 6.8 million tonnes in 1955 to 12.2 million tonnes in 1965 (80 per cent over a ten-year period), showing a cumulative annual growth rate of 6.1 per cent. Growth was fairly uniformly maintained throughout the period as the rate was 6.1 per cent between 1955 and 1960 and 6.3 per cent between 1960 and 1965 (see Table 1).

The increase in apparent consumption was substantially assisted by the expansion in the production of rollings, which occurred at a rate of 9.5 per cent a year during the ten-year period. The same is not true of imports, which remained practically stationary between 1955 and 1965 owing to the shortage of foreign exchange affecting practically all the Latin American countries. Exports were irregular and of little significance. Thus, in 1955, the local production component in apparent steel consumption was 49 per cent, with 51 per cent accounted for by net imports, while in 1965 the proportion was 74 per cent domestic production and 26 per cent net imports.

From the analysis by countries (see Table 1 and figure 1), it will be seen that there were considerable fluctuations in most of them throughout the period considered.

1/ Following the practice usually adopted to avoid duplication in production statistics, the figures for rolled products are converted to the equivalent in ingot steel. In this paper conversion of tonnes of rolled products to ingot steel equivalent is based on a single coefficient of 1.33. Shrinkage varies according to the particular rolling, but this coefficient represents a sufficiently close approximation for the purposes of this paper.

Table 1

LATIN AMERICA: TREND IN APPARENT CONSUMPTION OF ROLLED STEEL PRODUCTS IN 21 COUNTRIES

(Thousands of tonnes and kg per capita, ingot equivalents)

Country	1955		1960		1965		1966	
	1,000 t	kg per capita	1,000 t	kg per capita	1,000 t	kg per capita	1,000 t	kg per capita
Argentina	1,760	92	1,908	91	2,777	124	2,097	92
Bolivia	26	8	23	6	81	22	53	14
Brazil	1,683	28	2,830	40	3,000	37	3,701	44
Central America	118	13	171	16	364	29	301	23
Colombia	349	26	388	25	460	26	660	35
Cuba	269	44	216	32	-	-	-	-
Chile	334	49	331	44	618	72	814	93
Dominican Republic	51	20	35	12	27	8	-	-
Equador	56	15	50	12	67	13	-	-
Jamaica	-	-	-	-	119	66	-	-
Mexico	1,074	31	1,835	51	2,855	67	3,174	72
Panama	20	22	33	31	53	43	47	37
Paraguay	11	7	12	7	19	9	26	13
Peru	143	16	192	19	352	30	333	28
Trinidad and Tobago	-	-	142	167	94	96	78	78
Uruguay	117	50	157	63	92	34	110	40
Venezuela	745	123	654	89	1,049	120	817	91
Latin America	6,756	38	8,977	44	12,170[a/]	51	12,521[a/]	52

Source: Calculated on information supplied by the Latin American Iron and Steel Institute (ILAFA), Instituto Brasileiro de Siderurgia (IBS), national yearbooks of foreign trade and United Nations Demographic Yearbook.

a/ The total includes an estimate for countries for which complete data could not be obtained.

Figure 1

Apparent consumption of rolled steel products in Latin America and seven countries of the region

Thousands of tonnes - ingot equivalents
(Semilogarithmic scale)

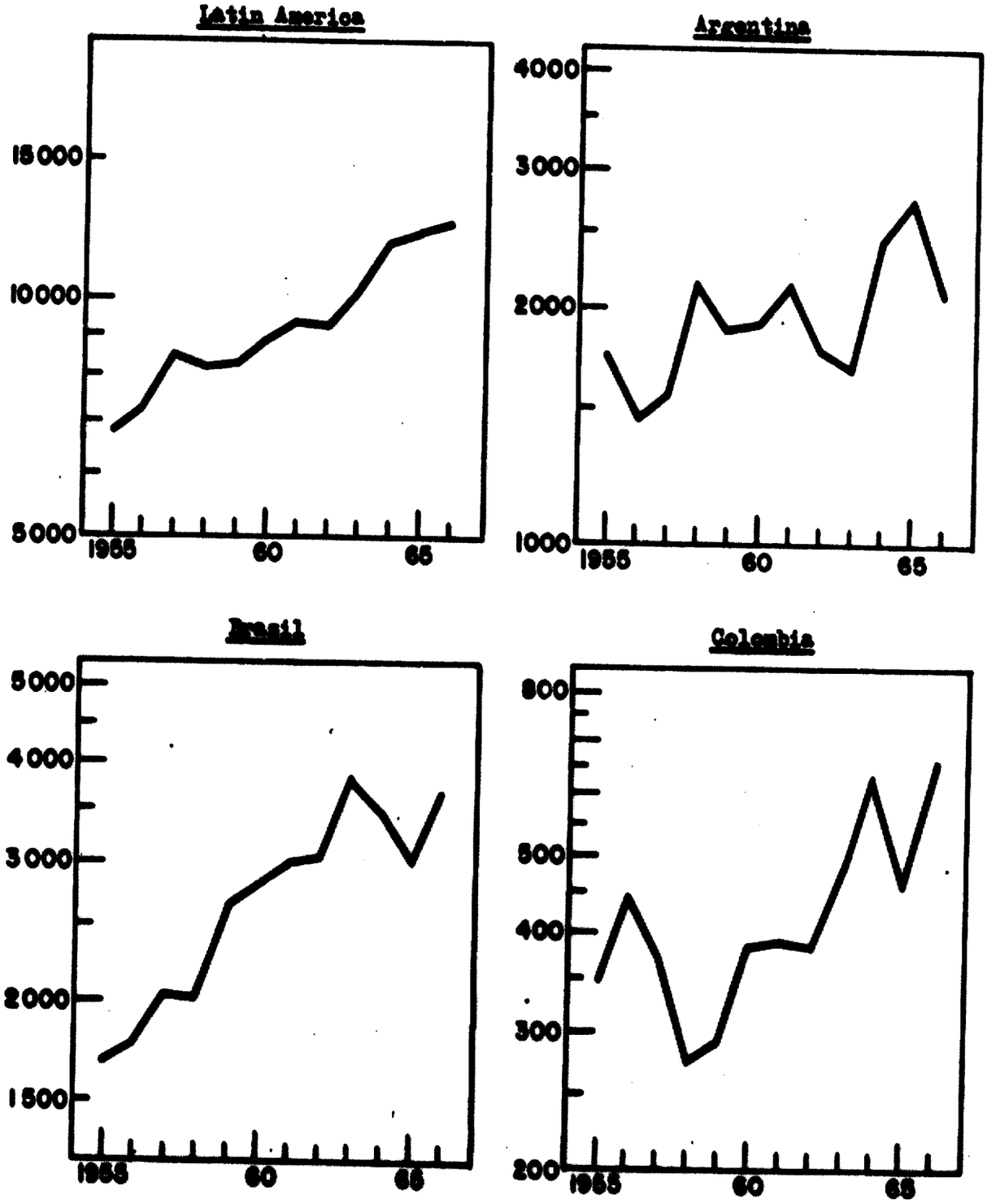
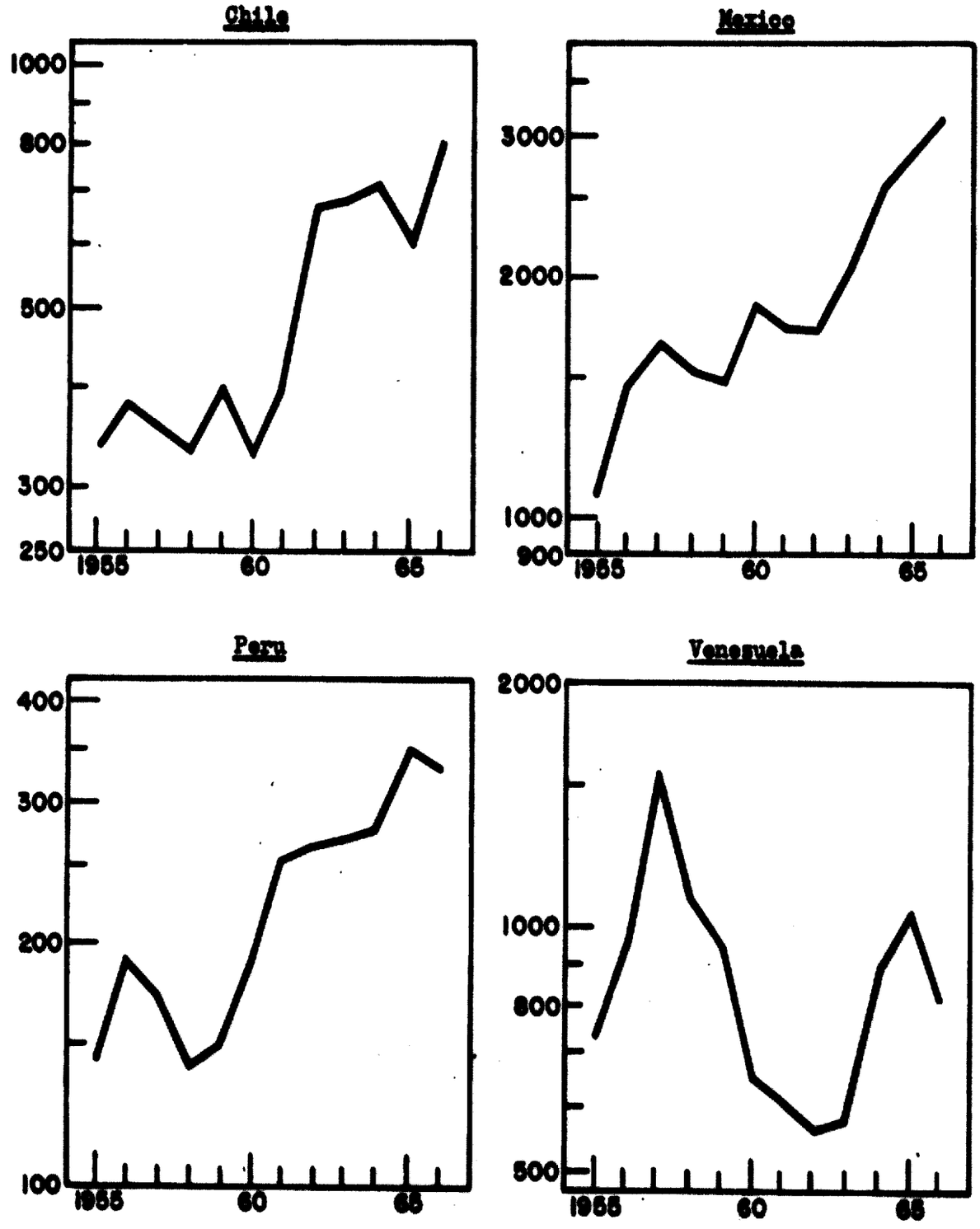


Figure 1 (continued)



In Argentina, during the five-year period 1955-1960, apparent consumption of rolled steel products grew at a mean annual rate of barely 1.7 per cent, which rose to 7.8 per oent in 1960-1965. The slow increase characteristic of the first five-year period persisted until 1963, principally owing to an almost total dependence on imports, which were severely limited in those years through shortage of foreign exchange. In 1963, the entry into operation of the integrated iron and steel plant at San Nicolás began to have an impact; it brought about a substantial increase in domestic steel production, with a corresponding rise in consumption, as imports remained at the same level as during the previous quinquennium.

Brazilian experience was the opposite. The rise in consumption was steady and sustained between 1955 and 1963, when there was a sharp decline that lasted until 1965 and was due to the contraction in the industrial sector which reached its climax precisely in that year. Consequently the growth rate for the two quinquennia was 11 per cent for the first (1955-1960) and only 1.2 per cent for the second. The situation is tending to change as a result of government development plans, mainly for civil and naval construction work.

Apparent consumption of rolled steel products in Colombia fluctuated widely during the ten year period 1955-1965. The main reason would appear to be the sensitivity of the Colombian economy to changes in its external sector; coffee accounts for approximately 80 per cent of all exports, so that any variation in world coffee prices affects the level of general economic activity and particularly manufacturing, with immediate repercussions on steel consumption, half of which, more or less, is met from imports.

Industrial production declined in Chile during the period between 1955 and 1960, following the drop in the population's purchasing power, which was in its turn the consequence of the substantial reduction, in real terms, of wage rates, and of a sharp contraction in private construction. All this weighed heavily on apparent consumption of rolled steel products, which remained relatively steady during the period, showing a small decline of 0.2 per cent. Recovery began in 1961 and the demand for rolled steel grew rapidly, taking up almost the whole of the domestic production as well as increased imports. The mean growth rate in apparent oonsumption for the period 1960-1965 climbed to 13.3 per cent.

Apparent consumption of steel in Mexico grew at a cumulative annual rate of 10.2 per cent during the period of 1955-1965. An important factor in this growth was the greater demand for manufactured products resulting from the general expansion in industrial activity throughout the ten-year period.

In Peru the construction sector and manufacturing industry grew at a faster rate after 1960 and consumption of rolled steel products consequently recorded a cumulative annual growth rate of 12.9 per cent for the period 1960-1965.

From 1950 until 1957 the Venezuelan economy was expanding more rapidly than that of any other Latin American country. Petroleum exports and investment in that sector were the principal dynamic factors in the expansion of the economy. In 1957, however, the terms of foreign trade deteriorated considerably, owing to the fall in the prices of petroleum products and the increase in the unit values of imports. This situation naturally affected the consumption of rolled steel products as these were almost entirely met from imports. After 1961 the Venezuelan economy began to react favourably and bringing the entry into operation of the Orinoco integrated plant encouraged consumption, which grew at the rate of 9.9 per cent a year during the quinquennium 1960-1965.

Although apparent consumption of rolled steel products grew significantly in Latin America during the ten year period 1955-1965, steel consumption per capita remained low. For the whole region, 1965 consumption per capita was about 51 kg in ingot equivalent. There were, however, wide individual variations, ranging from 9 kg per capita in Paraguay to 124 kg in Argentina (see Table 1).

The consumption of rolled steel by products is indicated in Table 2. The table shows the increase in the consumption of sheet and plate, whose share in the total consumption of rolled steel rose from 30 per cent in 1955 to 33 per cent in 1960 and 36 per cent in 1965. The rise in consumption of sheet and plate was particularly marked in such countries as Argentina, Brazil, Chile and Mexico, which contain most of the conversion industries producing durable consumer goods, as well as capital goods industries engaged in naval shipbuilding, vehicle-body manufacture, and the like, which are heavy consumers of such products.

Table 2 also shows that the share of tinplate in the consumption of rolled products has not varied. This is partly the consequence of the high price of tinplate on the Latin American market, especially in the countries where it is produced. Consumers seek ways of replacing tinplate by cheaper packings for all products where substitution is possible, or to economize by using a thinner guage strip, larger containers, etc.

Table 2 shows that, in the case of products other than flats, bars and light profiles account for the greatest share of overall consumption, as a result of activity in the construction industry.

Rails and heavy rolled profiles are declining because rails in general are not being replaced on a very wide scale in the countries of the region, and also because little is being done in the way of construction of new railways or extension of existing lines.

2. Demand projections

In so far as wide fluctuations in the consumption of rolled steel products are apt to occur in countries in the process of development (see, again, Table 1), it follows that the estimation of future demand must be a difficult task, especially in the present case, in which a long-term forecast extending to 1980 is required. ECLA, after trying various methods of estimating future demand, finally opted for a double-logarithmic correlation between apparent consumption of rolled steel products and the gross domestic product, since it found that this method yielded more consistent results in almost all the countries of the region.

The values calculated are shown in Table 3 and cover 94 per cent of the total population of the countries specified in Table 1, in which apparent consumption is shown.

As the only possible sources of the additional supplies of rolled products needed to meet the projected demand will be imports or local production, local production will have to increase in pace with the demand for rolled products, since it is unlikely that the shortage of foreign exchange affecting most of the countries of the region will be remedied in the next few years.

Table 2

LATIN AMERICA: APPARENT CONSUMPTION OF ROLLED STEEL, BY PRODUCTS, IN TWENTY COUNTRIES OF THE REGION

(Thousands of tonnes)

	1955						1960						1965					
	Bars and light profiles	Wire and rod	Rails, fittings and heavy profiles	Plates and sheets	Tinplate	Total rolled products	Bars and light profiles	Wire and rod	Rails, fittings and heavy profiles	Plates and sheets	Tinplate	Total rolled products	Bars and light profiles	Wire and rod	Rails, fittings and heavy profiles	Plates and sheets	Tinplate	Total rolled products
Argentina	484	164	188	380	107	1,323	633	175	86	441	89	1,434	868	227	50	831	112	2,088
Bolivia	8	2	2	8	1	21	6	2	1	7	1	17	43	4	2	11	2	62
Brazil	366	156	198	436	110	1,266	746	208	289	706	179	2,128	637	340	226	863	190	2,256
Central America	31	4	9	39	5	88	46	7	15	51	9	128	135	50	7	73	10	275
Colombia	120	29	15	85	14	263	83	55	15	110	28	291	135	78	13	93	26	345
Cuba	89	53	9	34	18	203	60	35	10	37	20	162	-	-	-	-	-	-
Chile	106	30	14	84	18	252	92	23	24	94	17	250	120	78	22	218	24	462
Dominican Republic	28	6	1	3	-	38	14	4	3	1	-	26	11	4	-	2	3	20
Equador	19	6	2	15	1	43	17	6	1	11	2	37	26	9	1	12	4	52
Jamaica	-	-	-	-	-	-	-	-	-	-	-	-	42	9	5	33	-	89
Mexico	271	39	167	277	54	808	485	130	203	486	75	1,379	761	199	217	820	137	2,134
Panama	6	3	1	4	1	15	12	4	2	6	2	26	20	5	1	11	4	41
Paraguay	1	2	-	3	1	7	2	3	1	1	2	9	4	4	1	3	2	14
Peru	47	11	11	31	8	108	53	14	10	50	16	143	113	21	16	91	24	265
Trinidad and Tobago	-	-	-	-	-	-	32	7	9	57	1	106	33	4	2	29	2	70
Uruguay	51	12	1	16	8	88	50	21	1	36	11	119	30	12	-	19	8	69
Venezuela	321	34	61	128	16	560	254	42	29	116	51	492	327	149	48	194	71	789
Latin America	1,948	551	679	1,543	362	5,083	2,595	736	703	2,210	503	6,747	3,342	1,214	618	3,339	638	9,151
Percentages	38	11	13	30	7	100	38	11	10	33	7	100	37	13	7	36	7	100 a/

Sources: Information from the Latin American Iron and Steel Institute (ILAFA), Instituto Brasileiro de Siderurgia (IBS), and national yearbooks of foreign trade.

a/ The total includes an estimate of consumption in Cuba, for which no information could be obtained.

Such an increase in production could be achieved by 1975, if there are no setbacks in the development plans of the iron and steel undertakings in the various countries. These plans are reasonably practicable, most of them being based on an increase in production arising out of technological improvements in the ore and steel reduction sections of the integrated iron and steel plants which, as will be seen later, have a very substantial surplus of installed rolling capacity.

Fulfilment of these plans implies production figures of the order shown below (the years shown in parenthesis indicate the dates by which expansion plans should be completed):

		Ingot tonnes per year
Argentina	(1974)	4,000,000
Brazil	(1972)	7,500,000
Colombia	(1974)	720,000
Chile	(1972)	1,060,000
Mexico	(1970)	4,500,000
Peru	(1970)	350,000
Venezuela	(1974)	1,350,000
Total		19,480,000

Table 3

LATIN AMERICA: PROJECTIONS OF DEMAND FOR ROLLED STEEL PRODUCTS IN SELECTED COUNTRIES

(Thousands of tonnes ingot equivalent)

	1970		1975		1980	
	Total (thousands of tonnes)	Kg/per cap.	Total (thousands of tonnes)	Kg/per cap.	Total (thousands of tonnes)	Kg/per cap.
Argentina	3,410	142	4,820	187	6,816	247
Brazil	5,590	60	8,486	79	12,890	104
Central America	419	28	636	36	966	45
Colombia	838	40	1,233	51	1,810	65
Chile	944	95	1,558	137	2,485	193
Ecuador	115	19	172	24	257	30
Mexico	3,949	78	5,898	98	8,807	122
Peru	488	36	740	47	1,123	61
Uruguay	190	66	250	82	328	100
Venezuela	1,247	120	1,878	151	2,830	196
Bolivia and Paraguay	75	11	105	13	148	16
Total	17,265	64	25,776	82	38,460	107

Source: ECLA estimates

II. THE IRON AND STEEL INDUSTRY IN LATIN AMERICA

1. Production

In 1955 Latin Amerioan production of ingot steel was 2.5 million tonnes; successive increases brought this to 8.3 million tonnes in 1965, so that there was a mean annual growth rate of 12.7 per cent (see Table 4).

Some countries of the region import semi-finished steel for re-rolling; the volume of finished rolled steel products is therefore higher than the steel production figure. Imports of semi-finished steel range from 400,000 to 700,000 tonnes a year, varying chiefly according to the importing capability of the countries in any particular year. (see Table 5).

The nucleus of the Latin American iron and steel industry at present consists of seventeen integrated iron and steel plants producing 80 per cent of the ingot steel tonnage of the region. The production figures for pig iron and steel plants are shown in Table 4.

Two integrated plants, both Brazilian, are omitted from the table for lack of information: Mogi das Cruzes (steel-making capacity 150,000 tonnes a year) and LAFERSA (annual production approximately 30,000 tonnes of ingot steel).

In addition to the integrated plants, there are various steel plants with rolling mills - semi-integrated plants - which use scrap as their raw material, and numerous re-rolling establishments that buy bars or billets in the market. Lastly, there is another group of undertakings, almost entirely confined to Brazil, whioh limit their activities exclusively to the production of pig iron in charcoal-burning blast furnaces.

The semi-integrated plants number fifty-five and account for the remaining 20 per cent of the region's steel production. Some countries suffer from a shortage of scrap to supply these plants and import quantities of the order of a million tonnes a year. There are also some 150 re-rolling establishments with plant capacity for rolling about 750,000 tonnes a year from billets and bars, but their production is variable, depending on the state of the market and, principally, on the supply of their prime material.

Table 4

LATIN AMERICA: PRODUCTION OF PIG IRON AND STEEL INGOTS

(Thousands of tonnes)

Country and plant	Pig iron production				Steel production			
	1955	1960	1965	1966	1955	1960	1965	1966
Argentina:								
Integrated plants								
San Nicolás	-	-	590	454	-	-	769	722
Zapla	-	24	74	66	-	-	72	64
Semi-integrated plants	-	-	-	-	218	277	527	481
Sub-total	-	24	664	520	218	277	1,368	1,267
Brazil:								
Integrated plants	-							
Volta Redonda	498	784	927	875	666	1,006	1,256	1,231
Usiminas	-	-	379	505	-	-	380	529
Cosipa	-	-	45	401	-	-	30	431
Belgo-Mineira	175	336	339	422	185	390	407	475
Mannesmann	-	71	122	80	-	111	195	198
Acesita	44	50	77	82	48	71	91	103
Barra Mansa	...	53	50	47	35	67	88	95
Aliperti	...	49	44	45	43	63	82	90
Semi-integrated plants	-	-	-	-	179	327	467	561
Sub-total	717	1,458[a]	1,983	2,457	1,156	2,260[a]	3,017[a]	3,713

Table 4 (Cont'd)

Country and plant	Pig iron production				Steel production			
	1955	1960	1965	1966	1955	1960	1965	1966
Colombia:								
Integrated plants								
Paz del Río	99	176	199	167	77	152	205	174
Semi-integrated plants	-	-	-	-	10	20	37	42
Sub-total	99	176	199	167	87	172	242	216
Chile:								
Integrated plants								
Huachipato	227	266	309	433	290	422	441	540
Semi-integrated plants	-	-	-	-	24	28	36	37
Sub-total	227	266	309	433	314	450	477	577
Mexico:								
Integrated plants								
Altos Hornos de México	190	509	559	765	250	689	1,111	1,185
Fundidora de Monterrey	141	161	284	372	161	202	448	533
Hojalata y Lámina	-	108	213	266	-	270	410	422
Semi-integrated plants	-	-	-	-	314	313	486	623
Sub-total	331	778	1,056	1,403	725	1,474	2,455	2,763
Peru:								
Integrated plants								
Chimbote	-	39	20	12	-	60	94	80

Table 4 (Cont'd)

Country and plant	Pig iron production				Steel production			
	1955	1960	1965	1966	1955	1960	1965	1966
Uruguay:								
Semi-integrated plants	-	-	-	-	10	10	13	10
Venezuela:								
Integrated plants	-	-	334	351	-	-	537	420
Orinoco			-	-	23	47	88	117
Semi-integrated plants								
Sub-total	-	-	334	351	23	47	625	537
Latin America:								
Integrated plants	1,374	2,741	4,565	5,343	1,755	3,728	6,637	7,292
Semi-integrated plants	-	-	-	-	778	1,022	1,654	1,871
Total	1,374	2,741	4,565	5,343	2,533	4,750	8,291	9,163

Source: Information from Latin American Iron and Steel Institute (ILAFA) and Instituto Brasileiro de Siderurgia (IBS)

a/ Including the production of Mogi das Cruzes and LAFERSA.

Table 5

LATIN AMERICA: HOT-ROLLED STEEL PRODUCTION, 1965

(Tonnes)

Products	Argentina	Brazil	Colombia	Chile	Mexico	Peru	Uruguay	Venezuela	Total
Rails, fishplates, sleepers, etc.	5,434	92,252	1,657	285	14,517	-	-	-	114,145
Heavy profiles	41,754	91,469	2,555	9,239	64,694	-	-	36,151	245,862
Light profiles	295,738	307,590	24,221	43,288	214,731	2,773	-	394	888,735
Reinforcing rods (for concrete)	284,909	231,330	87,459	47,323	397,576	60,792	18,443	151,273	1,279,105
Wire rod	231,196	281,209	72,770	75,366	192,457	10,158	-	82,543	945,699
Springs	69,581	43,379	-	-	8,043	-	-	-	121,003
Plates (over 4.75 mm)	54,641	281,242	-	48,163	284,067	-	-	-	668,113
Sheets (less than 4.75 mm)	440,978	750,714	18,118	161,373	734,299	-	-	-	2,105,482
Sheet for the electrical industries	-	12,000	-	1,372	-	-	-	-	13,372
Seamless tubes	92,947	52,488	-	-	127,824	-	3,149	96,792	373,200
Other rolled products a/	19,565	17,653	-	4,723	9,177	-	-	-	51,118
Total	1,536,743	2,161,326	206,780	391,132	2,047,385	73,723	21,592	367,153	6,805,834

Source: Latin American Iron and Steel Institute (ILAFA).

a/ Including certain types of rolled product not intended for immediate re-rolling, and also rod, square bars, etc., for forging and machining.

Considerable changes took place in the structure of the Latin American iron and steel industry during the ten years 1955-1965. Heavy investments were made in plant construction and seven integrated plants were brought into operation: Two in Argentina, two in Brazil, one each in Mexico, Peru and Venezuela. The older plants also increased their production, within the framework of more far-reaching plans for extension to be completed within the next few years. These developments include the installation of blast furnaces and a 130" wide-strip rolling-mill. Plants have been modernized in various ways including, in some cases, computerization for better process control.

New plants include blast furnaces of modern design, electric reduction furnaces, LD converters, continuous hot-strip mills, one of them 80", a wide-strip mill (120") and direct reduction plants producing sponge iron.

The production figures for the iron and steel plants show that two undertakings, the Companhía Siderúrgica Nacional in Brazil and Altos Hornos in Mexico, attained an annual output of ingot steel exceeding one million tonnes in 1960 and 1964 respectively.

The trend in the Latin American iron and steel industry over the period 1955-1965 can be summed up as follows:

1. Production of pig iron and steel increased by 232 per cent and 227 per cent respectively.
2. Some plants began to apply the latest technological advances.
3. Steel manufacture in LD converters was introduced in the region.
4. The proportion of flats in the volume of rolled products increased.
5. The entry into operation of new integrated plants resulted in improved geographical distribution of steel production over the region.

2. Installed capacity of the integrated iron and steel plant and its possible more intensive utilization

In the last few years technological advances in the iron and steel industry have had striking success in raising productivity in the processes in which they have been applied and there is every reason to suppose that the results will improve still further. It may be added that the increased production resulting from the application of these techniques entails no greater investment than that required to install new production units. This is a great advantage for the Latin American countries in which there is a shortage of capital, particularly for highly capital-intensive industries of this kind.

However, the stage so far reached by the Latin American integrated plants in the application of these advanced techniques is no more than a beginning. Only in a few cases is the necessary plant available for grading and sizing of raw materials to ensure optimum reductibility; the use of sinter is still very limited and pelletization is unknown. The Brazilian USIMINAS plant is the only one in the region that from the outset planned its installations to take 100 per cent of sinter. Other plants such as Volta Redonda, COSIPA, Belgo-Mineira, ACESITA, Barra Mansa, Altos Hornos of Mexico and Orinoco use sinter in proportions below 50 per cent.

The use made of such technological advances as higher pressure and temperature of blown air, control of air humidity, injection of hydrocarbons, etc., in blast furnaces is still limited in most of the Latin American plants. High output has been obtained by these methods from blast furnace No. 1 of the Chilean Huachipato plant. Designed for a daily capacity of 650 tonnes of pig iron, the plant has succeeded in producing a daily average of 1,202 tonnes over a year of operation with an average consumption of 541 kg of coke and 79 kg of petroleum per tonne of pig iron. Sinter is not used, but sizing of the charge is strictly controlled; a heating chamber has been installed to raise the temperature of the blown air, which is oxygen-enriched and humidity-controlled.

Many of the advanced techniques referred to in connexion with coke blast furnaces may also be applied to furnaces using charcoal. There is, for example, the Brazilian plant of Belgo-Mineira, where the charcoal furnaces have achieved remarkable productivity figures.

Table 6 shows the current situation regarding ore reduction in the Latin American integrated plants, and the total capacity that would be possible with the intensive application of advanced techniques.2/ This estimated production would amount to 8.9 million tonnes, some 27 per cent above the nominal installed capacity in 1966 and some 54 per cent higher than the total amount of cast iron produced by the plants in that year.

The integrated plants have been introducing advanced techniques as far as possible in their steel works. In some of them the use of oxygen has to be restricted as the design of the works does not permit the handling of the volume of materials required for larger-scale production of steel.

2/ For this estimate it was not possible to obtain operating figures for the blast furnaces in many of the Latin American plants, so that it is difficult to form a closer estimate of the production capacity that could be achieved through the application of advanced techniques in the reduction sections. It was therefore necessary to make use of the output known for furnaces in other plants as the basis for these estimates, bearing in mind the individual differences typical of blast furnace operation.

Table 6

LATIN AMERICA: NOMINAL PRODUCTION CAPACITY OF PIG IRON AND SPONGE IRON IN 1966, IN INTEGRATED PLANTS; POTENTIAL CAPACITY WITH THE APPLICATION OF ADVANCED TECHNIQUES

(Thousand tonnes/year)

Plants by countries	Coke blast furnaces	Charcoal blast furnaces	Electric reduction furnaces	Sponge iron	Total nominal capacity 1966	Total potential capacity
Argentina:						
San Nicolás	515				515	800
Zapla		143			143	170
Brazil:						
Volta Redonda	952				952	1,200
Usiminas	748				748	825
Cosipa	680				680	825
Belgo-Mineira		490			490	520
Mannesmann	170		85		255	330
Acesita		68	48		116	150
Barra Mansa		88			88	102
Aliperti		102			102	130
Colombia:						
Paz del Río	204				204	300

Table 6 (Cont'd)

Plants by countries	Coke blast furnaces	Charcoal blast furnaces	Electric reduction furnaces	Sponge iron	Total nominal capacity 1966	Total potential capacity
Chile:						
Huachipato	850				850	950
Mexico:						
Altos hornos de México[a/]	986				986	1,500
Monterrey	340				340	500
Hojalata y lámina				255	255	255
Peru:						
Chimbote			68		68	75
Venezuela:						
Orinoco			639		639	735
Total	5,445	891	840	255	7,431	9,367
Percentage of total	73.3	12.0	11.3	3.4	100.0	

Source: Data from ECLA, the Latin American Iron and Steel Institute (ILAFA) and the Instituto Brasileiro de Siderurgia (IBS)

a/ A new blast furnace with a nominal capacity of five hundred thousand tonnes/year came into operation in December 1966.

Table 7 shows the nominal capacity of the steel producing furnaces in 1966, the types of furnace used and the capacity that could be attained by the application of advanced technology; the estimates are based on productivity figures compiled by the Economic Commission for Europe.3/ The table indicates potential capacity for the integrated plants as a whole as 12.1 million tonnes, some 66 per cent above the production obtained from the same plants in 1966.

3/ Comparison of steel-making processes, United Nations, New York 1962, Sales No. 62.II.E.4, p.51:

According to approximate calculations, and taking into account to some extent expected improvements in processes, different steel-making installations, may be characterized by the following annual productivity per ton of installed capacity producing low-carbon steels:

Low-phosphorus iron

Open-hearth furnace with oxygen	1,000 - 1,200 (a)
Cold-charged electric-arc furnace	1,500 - 2,000
Electric-arc furnace with pre-refined metal	2,500 - 3,000
Electric-arc furnace with 50% to 70% of hot iron	2,500 - 3,000
LD converter	7,000 - 9,000

(a) According to preliminary data open-hearth furnaces with oxy-fuel jets can attain a productivity of 1,500 to 2,000 tons per year per ton of capacity.

High-phosphorus pig-iron

Tilting open-hearth furnace with oxygen	900 - 1,000
Electric-arc furnace with pre-refined metal	2,500 - 3,000
Electric-arc furnace with 50% to 70% direct hot iron	2,000 - 2,500
Thomas converter with steam-oxygen or oxygen-carbon dioxide mixture	8,000 - 9,000

Table 7

LATIN AMERICA: NOMINAL STEEL PRODUCTION CAPACITY IN INTEGRATED PLANTS (1966) AND POTENTIAL CAPACITY WITH THE APPLICATION OF ADVANCED TECHNIQUES

Plants by Countries	Installed capacity in tonnes					Total potential annual capacity in thousands of tonnes
	Siemens-Martin furnaces	Electric furnaces	LD Converters	Thomas & Bessemer Converters	Total installed capacity in 1966	
Argentina:						
San Nicolás	1,125				1,125	1,125
Zapla		24		30	54	246
Brazil:						
Volta Redonda	1,600				1,600	1,600
Usiminas			110		110	880
Cosipa			150		150	1,200
Belgo-Mineira	190		60		250	670
Mannesmann		85		50 a/	135	478
Acesita		64		10 a/	74	160
Barra Mansa	100				100	100
Aliperti	87	20			107	117
Colombia:						
Paz del Río		20		66.	86	492
Chile:						
Huachipato	600				600	600
México:						
Alto Hornos de México	1,685 b/				1,685	1,685
Monterrey	1,135 b/				1,135	1,135
Hojalta y Lámina		351			351	527
Perú:						
Chimbote		50			50	100
Venezuela:						
Orinoco	1,000				1,000	1,000
Total	7,522	614	320	156	8,612	12,115
% of total	87.4	7.1	3.7	1.8	100.0	

Source: Information from ECLA, ILAFA and IBS.

a/ Duplex working is used for the converter.

b/ A new Siemens-Martin furnace of 275 tonnes capacity began to operate in September 1966.

Up to now advanced technology has been incorporated only to a limited extent in the reduction and steel-making sections of the integrated plants, except in a few rare cases. In Table 8 the production obtained in these sections in 1966 is compared with what would be possible if advanced techniques were applied more intensively. The calculations show that the plants were producing in the aggregate only 57 per cent of the pig iron and only 60 per cent of the steel that could have been manufactured.

In the analysis by plants, Hojalata y Lámina is outstanding as it is the only one utilizing direct reduction methods, developed through its own research, in the whole region. Next comes Belgo-Mineira, the first to introduce advanced technology in the region, sometimes, as in the case of sinterization and the use of LD converters, when there was still no certainty about the industrial success the process might have. It introduced sinterization in 1948 and the LD process in 1957. This private enterprise firm provides a typical illustration of the results that can be obtained when improved techniques are put into operation. The charcoal blast furnaces of its Monlevade plant were originally designed for 90 tonnes a day of pig iron; within a few years, when the plant had been run in and with the use of sinter, capacity rose to 150 tonnes a day. Subsequently the same furnaces, with larger hearths, a higher proportion of sinter in the charge and new techniques, have achieved a capacity of 350 tonnes a day.

Detailed breakdown of the installed productive capacity in the integrated plants shows that their weak point is in the blooming and rolling departments, where in most cases the plants have unused capacity - one of the factors accounting for the high cost of producing rolled steel.

Table 8

COMPARISON OF PRODUCTION ATTAINED IN 1966 BY THE REDUCTION AND STEEL-MAKING SECTIONS OF THE INTEGRATED PLANTS WITH POTENTIAL CAPACITY USING ADVANCED TECHNIQUES

(Index of potential capacity = 100)

Plants by countries	Reduction	Steelmaking
Argentina:		
San Nicolás	57	64
Zapla	39	26
Brazil:		
Volta Redonda	73	77
Usiminas	61	60
Cosipa	49	36
Belgo-Mineira	81	71
Mannesmann	24	41
Acesita	55	64
Barra Mansa	46	95
Aliperti	35	77
Colombia:		
Paz del Río	56	35
Chile:		
Huachipato	46	90
Mexico:		
Altos Hornos de México	51	70
Monterrey	74	47
Hojalata y Lámina	104	81
Peru:		
Chimbote	16	61
Venezuela:		
Orinoco	48	42
Total	57	60

Source: ECLA

Tables 9 and 10 indicate the nominal blooming and hot rolling capacity[4/] of the integrated plants, according to information supplied by the manufacturers of the equipment or the firms utilizing it. The tables also show the percentage utilization that would have been attained if in each plant the whole quantity of ingot steel produced had been bloomed and subsequently hot-rolled.

Table 9 shows that the total nominal installed blooming capacity of the undertakings was 13.8 million tonnes, 48 per cent more than the production of ingot steel achieved by these undertakings in 1966. In that year, only four undertakings were utilizing more than 80 per cent of their blooming capacity, while nine were using less than 51 per cent.

Table 10 shows that in 1966 production of ingot steel in the integrated plants as a whole was sufficient to take up only half the installed hot-rolling capacity; only two plants were using more than 80 per cent of their capacity while eight were using less than 52 per cent. Among those eight plants were some of the biggest in the region, accounting for 58.4 per cent of total installed rolling capacity.

To sum up, with more intensive application of advanced techniques, the reduction and steel-making sections could raise their production of pig iron and steel by 43 and 40 per cent respectively above the figures for 1966. The existence of substantial unused capacity in the blooming and hot-rolling sections requires that the plants should raise their output of steel as soon as possible, since the manufacture of rolled products from semi-finished imports is restricted by the lack of foreign exchange.

4/ Hot-rolling capacity is estimated on the assumption that cold-rolling capacity is sufficiently flexible to deal with market fluctuation.

Table 9

BLOOMING MILL CAPACITY, LATIN AMERICAN INTEGRATED PLANTS, IN 1966

(Thousands of ingot tonnes)

Plants by countries	Type of mill. Diameter of rolls	Total nominal capacity in thousands of tonnes	Comparison between 1966 steel production and installed blooming capacity Blooming capacity = 100
Argentina:			
San Nicolás	Two-high reversing 46"	1,500	48
Zapla	Three-high " 28"	180	36
Brazil:			
Volta Redonda	Two-high reversing 40"	1,400	88
Usiminas	" " " 59"	1,800	29
Cosipa	" " " 44"	1,500	29
Belgo-Mineira	" " " 39"	650	73
Mannesmann	Three-high 30"	300	66
Acesita	Two-high reversing 34"	240	43
Barra Mansa	" " " 28"	180	57
Aliperti	" " " 28"	180	50
Colombia:			
Paz del Rio	Three-high 28"	180	97
Chile:			
Huachipato	Two-high reversing 32"	650	83
Mexico:			
Altos Hornos de Mexico	Two-high reversing 30"[a/]	200	79
	" " " 44"		
Monterrey	" " " 46"	1,500	36
Hojalata y Lámina		450	95
Peru:			
Chimbote	Three-high 26"	120	51
Venezuela:			
Orinoco	Two-high reversing 44"	1,500	28
Total		13,850	52

Source: Direct information from ECLA, Latin American Iron and Steel Institute (ILAFA) and Instituto Brazileiro de Siderurgia (IBS).

a/ Altos Hornos of Mexico has two blooming sections, one at Monclova and the other at Lachería.

Table 10

HOT ROLLING CAPACITY, LATIN AMERICAN INTEGRATED PLANTS

(Thousands of tonnes)

Plants by countries	Flat rollings	Square bars, rails and heavy profiles	Bars, light profiles and rod	Seamless tubes	Total rolling capacity	Comparison of steel production in 1966 and installed hot rolling capacity (rolling capacity = 100)
Argentina:						
San Nicolás	1,000	1,210	-	-	2,210	25
Zapla	-	-	120		120	40
Brazil:						
Volta Redonda	1,000	300	-	-	1,300	71
Usiminas	1,000	-	-	-	1,000	40
Cosipa	900	-		-	900	36
Belgo Mineira	120	-	300	-	420	85
Mannesmann	-	-	100	160	260	57
Acesita	50	-	130	-	180	43
Barra Mansa	-	-	150	-	150	47
Aliperti	-	-	120	-	120	56
Colombia:						
Paz del Río	40	-	180	-	220	59
Chile:						
Huachipato	350	-	170	-	520	78

Table 10 (Cont'd)

Plants by countries	Flat rollings	Square bars, rails and heavy profiles	Bars, light profiles and rod	Seamless tubes	Total rolling capacity	Comparison of steel production in 1966 and installed hot rolling capacity (rolling capacity = 100)
Mexico:						
Altos Hornos de México	800	300	200	-	1,300	69
Monterrey	1,000	150	100	-	1,250	32
Hojalata y lámina	350	-	-	-	350	92
Peru:						
Chimbote	16	-	65	-	81	57
Venezuela:						
Orinoco	-	-	320	295	615	51
Total	6,626	1,960	1,955	455	10,996	50

Source: Information from ECLA, Latin American Iron and Steel Institute (ILAFA), Instituto Brasileiro de Siderurgia (IBS).

To illustrate the foregoing, the situation in the integrated plants would be that indicated in Table 11, in which potential steel production using advanced techniques is compared with existing blooming and hot-rolling capacity. The table lists three plants that would have a considerable excess of steel-making capacity; Zapla, Mannesmann and Paz del Río. Of these, Paz del Río is building an extension in two stages that will be finished by about 1973 and which would raise its production of rollings to 500,000 tonnes a year.

Five plants would continue to show a serious imbalance: San Nicolás, USIMINAS, ACESITA, Barra Mansa and Monterrey, however these plants have expanaion projects in hand.

The San Nicolás plant is in fact increasing its steel production from 800,000 to 1,100,000 tonnes a year through the application of advanced techniques. It is installing an oxygen plant to supply its Siemens Martin furnaces and sinterizing equipment for its blast furnace. When this expansion project is completed, a second will be begun, possibly towards the end of 1968, entailing the installation of another coking plant, a new blast furnace and an LD steel making plant. A credit for this has already been granted by EXIMBANK. The project, which would increase steel production to 2 million tonnes, should come into operation in 1973. Projects shortly to be realized, as financial arrangements are now in progress, are the extension plans of USIMINAS, ACESITAS, and Barra Mansa, which will raise their steel production to one million, 220,000 and 160,000 tonnes a year respectively (see Table 12).

Finally, the imbalance of the Monterrey plant will be eliminated as a result of a blast furnace, that was inaugurated at the end of 1967, and new Siemens Martins furnaces that are now being installed.

In this way the present lack of balance in the Latin American iron and steel industry should be remedied within a few years.

Table 11

COMPARISON OF POTENTIAL STEEL PRODUCTION USING ADVANCED TECHNIQUES AND ACTUAL BLOOMING AND HOT-ROLLING CAPACITY

(Indices)

Plants by Countries	Comparison between steelmaking and blooming, blooming = 100	Comparison between steelmaking and hot-rolling, hot-rolling = 100
Argentina:		
San Nicolás	75	38
Zapla	137	154
Brazil:		
Volta Redonda	114	93
Usiminas	49	66
Cosipa	80	100
Belgo-Mineira	103	120
Mannesmann	159	138
Acesita	67	67
Barra Mansa	56	50
Aliperti	65	73
Colombia:		
Paz del Río	273	168
Chile:		
Huachipato	92	87
Mexico:		
Altos Hornos de México	112	98
Monterrey	76	68
Hojalata y Lámina	117	113
Peru:		
Chimbote	83	93
Venezuela:		
Orinoco	67	122
Total:	88	83

Source: ECLA

Table 12

LATIN AMERICA: EXTENSION PLANS AND INVESTMENTS IN SOME OF THE INTEGRATED PLANTS

Plants by countries	Present capacity (thousands of tonnes of ingot steel)	New capacity (thousands of tonnes of ingot steel)	Investment in US $ millions	To be completed in	
Argentina:					
San Nicolás	800	1,100	30	1968)	Financed
	1,100	2,000	195	1973)	Partly financed
Brazil:					
Volta Redonda	1,400	2,500	294	1972)	
Usiminas	636	1,000	70	1972)	
Cosipa	625	1,000	62	1972)	
Belgo-Mineira	400	520	25	1972)	Financing in progress
Acesita	120	220	40	1972)	
Barra Mansa	90	160	4	1972)	
Colombia:					
Paz del Río	180	250	45	1968)	Financed
	250	650	120	1974)	Financing in progress
Chile:					
Huachipato	625	1,000	128	1971	Financing arrangements largely completed
Mexico:					
Altos Hornos	1,500	2,000	65	1970	Financing arrangements largely completed
Monterrey	500	1,000	50	1969	Financing arrangements largely completed
Peru:					
Chimbote	75	350	142	1970	Financing arrangements largely completed
New Plants					
Brazil:					
Cosima	50		18	1972	Financing in progress
Usinor	120		50	1972	Financing in progress
Mexico:					
Hojalata y Lámina, Puebla	285		54	1969	Financed

3. Reasons for the imbalance between steel production and blooming and hot-rolling capacity

Before the development of the iron and steel industry, the Latin American countries now producing steel had to resort to imports to meet the demand for rolled steel products. As expansion in steel consumption thus depended on the quantities each country was in a position to purchase and not on the magnitude of potential demand on the part of domestic markets, it would seem logical to conclude that when rollings were produced locally there would be a very rapid and sustained growth in demand, encouraged by the assurance of more normal supply conditicns, free from the problems of foreign exchange shortage or restrictions of export markets.

Under the influence of these considerations, many of the projects that led to the establishment of the integrated plants were conceived in terms of larger production capacity than the needs of the moment could justify, and this, combined with the impossibility of dissociating some of the processes used in iron and steel-making, led to the imbalance with which we are now familiar. It was thus inevitable that in some cases rolling mills were designed for a larger capacity, so as to avoid future problems of expansion and possible loss on the initial investment through the need to replace small-capacity units. The increase in rolling capacity is also explained by the fact that, as the mills were planned to achieve maximum substitution for imports, it was necessary to produce the widest possible range of types of rolling. It was assumed that the iron and steel plants would achieve a balanced output within a reasonably brief period, once the first stage of construction had been completed. But this did not prove to be the case. The undertakings' financial resources were not sufficient, after coping with the cost of installing the plant and starting up the first stage of operations; and it had taken far longer than anticipated to reach a satisfactory financial position enabling them to undertake immediate expansion. (See also "The iron and steel industry in Latin America" E/CN.12/727.)

III. RAW MATERIALS

1. Iron ore

Proved reserves of iron ore in Latin America amount to almost 5,000 million tonnes and estimated reserves to some 85,000 million tonnes. Brazil has the greatest supply, with proved deposits of 2,000 million tonnes and estimated reserves of over 40,000 million tonnes, of which about 13 per cent are hematite ore with an iron content of over 60 per cent. Venezuela comes second, with 1,500 million tonnes of proved deposits and 500 million tonnes of estimated reserves, followed by Peru with 320 million tonnes of proved deposits and about 500 million estimated reserves. Mexico, Chile, Argentina and Colombia also have substantial resources. The largest known deposits, with reserves estimated at 42,000 million tonnes, are in the Mutún district of Bolivia and have not yet been exploited.

With the exception of Argentina, which imports iron ore for its integrated plant at San Nicolás, all the countries in the region with integrated plants utilize their own ores. In Argentina there is a project for exploiting the Sierra Grande ore deposits and producing pellets with a 68 per cent iron content and low percentages of phosphorus and sulphur, partly to supply the San Nicolás plant and the rest for export.

The cost of the iron ores used in the Latin American iron and steel plants, other than San Nicolás, is fairly low compared with prices paid in most of the world iron and steel centres. This is because they are able to draw their supplies from open oast mines mostly at relatively short distances from the plants. (See Table 13). In addition, in Brazil, Chile, Peru and Venezuela the ore used in the iron and steel plants comes from large-scale mines mainly developed for export purposes. (See Table 14).

Table 13

LATIN AMERICA: IRON ORE USED IN INTEGRATED IRON AND STEEL PLANTS

	Source	Type of ore	Iron content	Mode of transport to iron and steel plant	Average distance between mine and plant
Argentina:					
San Nicolás	Imported	Hematite	63	Ship	
Zapla	Zapla	Hematite	46	Rail	12 km
Brazil:					
Volta Redonda	Minas Gerais	Hematite	65	Rail	420 km
Usiminas	Minas Gerais	Hematite	62	Rail	119 km
Cosipa	Minas Gerais	Hematite	62	Ship	850 miles
Belgo-Mineira	Minas Gerais	Hematite	65	Rail	10 km
Mannesmann	Minas Gerais	Hematite	62	Cable railway	6 km
Acesita	Minas Gerais	Hematite	62	Rail	100 km
Barra Mansa	Minas Gerais	Hematite	62	Rail	430 km
Aliperti	Minas Gerais	Hematite	62	Rail	950 km
Colombia:					
Paz del Río	Paz del Río	Limonite and hematite	46	Rail	36 km
Chile:					
Huachipato	El Romeral	Hematite	61	Ship	453 miles
Mexico:					
Altos Hornos de México	Ciudad Camargo	Hematite	60	Rail	350 km
Monterrey	Durango		62	Rail	600 km
Hojalata y Lámina					
Peru:					
Chimbote	Marcona	Hematite	60	Ship	350 miles
Venezuela:					
Orinoco	El Pao	Hematite	58	Ship	22 miles

Source: ECLA

Table 14

LATIN AMERICA: IRON ORE EXPORTS

(Thousands of tonnes)

Year	Brazil	Chile	Peru	Venezuela	Mexico
1955	2,565	1,237	1,697	9,791	186
1960	5,240	5,191	5,171	19,487	166
1965	12,386	10,728	7,409	17,100	140
1966	12,910	11,094	7,835	17,037	-

Source: Latin American Iron and Steel Institute (ILAFA)

2. Coking Coal

The situation in regard to coking coal is different from that concerning iron ore. The region is not rich in coal seams of coking quality and only two countries, Colombia and Mexico, have mines that supply their iron and steel industries. In both cases the coalfields are a long way from the coast and carriage to the ports is expensive. In the circumstances, the price of the local fuel is rather higher than that of the North American coking coal used in coke blast-furnaces in the other producer countries of the region (see Table 15).

3. Scrap

At present there is a shortage of scrap in some of the countries of the region and imports are necessary. The chief importing country is Mexico, which consumes 75 per cent of the million tonnes, more or less, imported annually. The chief consumers of scrap are the semi-integrated plants, which use more than 90 per cent of scrap in their furnace charges, as a consequence of the high price of pig iron.

The shortage of scrap would be largely resolved if its collection were effectively organized. User-controlled firms could be set up to deal systematically with scrap collection, sorting and transport, replacing the present system whereby small dealers generally pick up scrap locally around the consuming centres.

4. Manpower

As the iron and steel industry is of recent development in the region, there is no supply of manpower specially skilled in iron and steel processes and training becomes the direct responsibility of the enterprises. The method the undertakings use to recruit most of their staff of workers, technicians and even engineers is to make a selection among the most suitable members of the labour force engaged in assembling the plant equipment and to give them a short training course to fit them for their new jobs. This is how a work force is built up either in the case of a new plant or of extension of an existing plant.

Table 15

LATIN AMERICA: COAL USED IN THE INTEGRATED IRON AND STEEL PLANTS

	Source of coal
Argentina:	
San Nicolás	100 per cent imported from USA
Zapla	Charcoal, own production
Brazil:	
Volta Redonda	40% domestic supply, 60% imported from USA
Usiminas	40% domestic supply, 60% imported from USA
Cosipa	40% domestic supply, 60% imported from USA
Belgo-Mineira	Charcoal, own production
Mannesmann	Imported coke
Acesita	Charcoal, own production and imported coke
Barra Mansa	Charcoal (purchased)
Aliperti	Charcoal (purchased)
Colombia:	
Paz del Rio	Paz del Rio coalfield
Chile:	
Huachipato	60% domestic product - 40% imported from USA
Mexico:	
Altos Hornos de Mexico	Domestic coal
Monterrey	Domestic coal
Hojalata y Lámina	Natural gas
Peru:	
Chimbote	Reduction in electric furnaces - imported coke
Venezuela:	
Orinoco	Reduction in electric furnaces - imported coke

Source: ECLA

IV. INTRA-REGIONAL TRADE IN ROLLED STEEL PRODUCTS

The increasing pressure of imports of rolled steel products on the foreign exchange budget of the Latin American countries was one of the most potent factors that induced some governments to promote the installation of iron and steel plants. The plants were therefore planned with a view not so much to conquering the national market as to replacing imported products to the greatest extent possible. Consequently the producing countries of the region are not regular exporters of rolled steel, and when they do export it is the result of temporary contraction of the internal markets. It may be added that the prices of locally produced steel rollings are high compared with the international competition.

There is a tendency for this situation to change and plans are being made to take advantage of some of the very favourable locations available in the region for the installation of large iron and steel plants oriented chiefly to production for export to world markets. The plan nearest realization provides for the construction of a plant with an initial capacity of one and a half million tonnes of ingot steel in the vicinity of Vitoria, the chief Brazilian port for the export of iron one.

Tables 16 and 17 show the volume of imports and exports of rolled steel products in ingot steel equivalents. The table confirms that imports are practically at a standstill, as was mentioned earlier.

Table 16

LATIN AMERICA: IMPORTS OF ROLLED STEEL PRODUCTS IN TWENTY-ONE COUNTRIES OF THE REGION

(Thousands of tonnes ingot equivalent)

Country	1955	1960	1965	1966
Argentina	883	880	770	493
Bolivia	26	23	81	53
Brazil	459	578	348	418
Central America	118	171	364	301
Colombia	293	236	184	351
Cuba	269	216	-	-
Chile	67	63	104	180
Dominican Republic	51	35	27	-
Ecuador	56	50	67	-
Jamaica	-	-	119	-
Mexico	314	286	311	378
Panama	20	33	53	47
Paraguay	11	12	19	26
Peru	143	134	254	242
Trinidad and Tobago	-	142	93	78
Uruguay	86	115	63	72
Venezuela	718	587	650	474
Latin America	3,514	3,561	3,651[a/]	3,423[a/]

Source: National year books of foreign trade.

a/ The total includes an estimate of imports by countries for which data could not be obtained.

Table 17

LATIN AMERICA: EXPORTS OF ROLLED STEEL PRODUCTS

(Thousands of tonnes ingot equivalent)

Country	1955	1960	1965	1966
Argentina	-	-	37	91
Brazil	16	25	222	184
Colombia	-	-	-	4
Chile	57	131	7	13
Mexico	5	23	179	165
Venezuela	-	-	89	62
Latin America	78	179	534	519

Source: National year books of foreign trade.

V. SOME FINANCIAL DATA ON INTEGRATED PLANTS

The first integrated iron and steel plant of any size in Latin America was the Compañía Fundidora de Fierro y Acero de Monterrey, S.A., founded in 1900. The plant came into operation in 1903 with a blast furnace of 300 tonnes daily capacity, three Siemens-Martin furnaces, each of 35 tonnes, and rolling mills for rails, structural profiles, bars and light profiles. Its steel production reached 85,000 tonnes in 1911. As a result of the Mexican revolution, which sought to transform the country's traditional economy, the firm had to work below capacity and intermittently for 17 years. In 1928 national demand for steel recovered to the 1911 level. A little later, the 1930 world crises had its repercussions on the Mexican steel market. In 1934 steel consumption began to rise steadily, to the point that in 1944 a new plant, Altos Hornos de Mexico S.A., began to produce flat rolled products.

In Brazil, the richness and abundance of Brazilian iron ore deposits very early aroused interest in the prospect of an iron and steel industry. A number of attempts at development were made during the nineteenth century, but without much success, largely owing to the lack of transport.

The conditions brought about by the First World War and a number of government measures helped to further various iron and steel projects developed on the basis of the country's past experience, that is, in charcoal blast furnaces. As a result, the Belgo-Mineira Monlevada plant was established early in 1938, Aliperti in 1942 and Barra Mansa in 1943. In 1946 production of pig iron in coke blast-furnaces began in Brazil, at the Volta Redonda plant of the Companhia Siderúrgica Nacional, marking the beginning of the most up-to-date and extensive development in the iron and steel industry of the region.

From 1946 onwards integrated plants began to be established in other Latin American countries. In 1950 the Compañia de Acero del Pacifico S.A. started operations in Chile; Acerías Paz del Río S.A. in Colombia in 1954; Hojalata y Lámina S.A., in Mexico, was converted from a semi-integrated to an integrated plant in 1958; in the same year the Sociedad Siderúrgica de Chimbote S.A. was

established in Peru; the Sociedad Mixta Siderurgia Argentina in Argentina in 1961; the Siderúrgica del Orinoco in Venezuela in 1962; and in 1964 the Dirección General de Fabricaciones Militares of Argentina converted its semi-integrated plant at Zapla into an integrated plant. In addition, the following undertakings were started in Brazil: the Companhia Aços Especiais Itabira S.A. in 1949; the Companhia Siderúrgica Mannesmann S.A. in 1954; Usinas Siderúrgioas de Minas Gerais S.A. in 1963 and the Companhia Siderúrgica Paulista S.A. in 1964.

Table 18 presents some information on the capital structure of the integrated iron and steel enterprises and the sources of their principal foreign credits. In the case of the Sociedad Mixta Siderurgia Argentina, the Dirección General de Fabricaciones Militares, the Companhia Siderúrgica Nacional, the Companhia Siderúrgica Paulista, Aços Especiais Itabira, Sociedad Siderúrgica de Chimbote and Siderúrgica del Orinoco most of the capital is provided by the State, either directly or through its industrial development bodies. On the other hand the Usinas Siderúrgicas de Minas Gerais and Altos Hornos de México, in which the State has a substantial holding, enjoy a high degree of administrative independence. The Compañia de Acero del Pacifico (Chile) is run as a private joint-stock company but was established by a government body, the Corporación de Fomento de la Producción. The only integrated undertakings wholly in private hands are the Companhia Siderúrgica Belgo-Mineira, most of whose shares are owned by ARBED of Luxembourg, the Companhia Siderúrgica Mannesmann, of which the Mannesmann Group holds most shares, J.L. Aliperti S.A. and Siderurgia Barra Mansa S.A. Acerías Paz del Río S.A. may be included in this group as practically all the capital is now privately held, the original constitution of the enterprise having permitted the gradual transfer of shares. This will be the first case of a State enterprise changing its character and becoming a private undertaking. In some countries the intention of the governments was to set up an iron and steel industry so that subsequently local private enterprise would acquire the capital or participate very actively in the financing of the undertaking. However, the volume of investment required for the establishment of this kind of industry, made even greater in this case by the need to build up the infrastructure, and the uncertainty concerning its profitability, had a decisive effect, in most cases, in discouraging private capital from taking an enthusiastic part in these iron and steel projects, so that the responsibility for promoting them was left with the Governments.

Table 18

LATIN AMERICA: SOME FINANCIAL DATA ON INTEGRATED PLANTS

Name of enterprise	Location of plant	Production (ingot) 1966	State Capital	Domestic private investment	Direct foreign investment	Chief source of external credit
		(Thousands of tonnes)				
Argentina						
Sociedad Mixta Siderurgia Argentina (SOMISA)	San Nicolás	722	Almost all			Eximbank
Dirección General de Fabricaciones Militares	Zapla	64	All			
Brazil						
Companhia Siderúrgica Nacional	Volta Redonda	1,231	Almost all			Eximbank
Usinas Siderúrgicas de Minas Geraie S.A. (USIMINAS)	Ipatinga	529	More than half	Small amount	40%	
Companhia Siderúrgica Paulista S.A. (COSIPA)	Cubatao	431	Almost all			
Companhia Siderúrgica Belgo-Mineira S.A.		475		Small amount	The majority	Suppliers' credits
Companhia Siderúrgica Mannesmann S.A.	Belo Horizonte	198		Small amount	The majority	
Companhia de Acoe Especiais Itabira (ACESITA)	Coronel-Fabriciano	103	Almost all			Bank of Paris & the Netherlands, Demag
Siderúrgica J.L. Aliperti S.A.	Sao Paulo	90		All		Bank of Paris & the Netherlands
Siderúrgica Barra Mansa S.A.	Barra Mansa	95		All		
Colombia						
Acsrías Paz del Río S.A.	Belencito	174	Approx. 5%	Approx. 95%		Bank of Paris & the Netherlands, International Bank for Re-Construction and Development
Chile						
Compañía de Acero del Pacífico S.A. (CAP)	Huachipato	540	Approx. half	Approx. 2/3	Small amount	Eximbank
Mexico						
Altos Hornos de México S.A.	Monclova	1,185	The majority			Eximbank
Compañía Fundidora de Hierro y Acero de Monterrey S.A.	Monterrey	533		All		Eximbank
Hojalata y Láminas S.A.	Monterrey	422		All		Eximbank
Peru						
Sociedad Siderúrgica de Chimbote S.A.	Chimbote	61	All			Bank of Paris & the Netherlands, Ferrestal
Venezuela						
Siderúrgica del Orinoco	Santo Tomé	420	All			Eximbank

Source: ECLA

Some contribution has been made by foreign private capital in a number of countries: on a fairly substantial scale in Brazil, and to a lesser extent in Mexico and Chile. It may therefore be said that, in general, in Latin America and in the prevailing conditions, local investors and direct foreign capital have shown little interest in the integrated iron and steel industry compared with the engineering and manufacturing industries. Public initiative in the development of the iron and steel industry has therefore been of decisive importance.

VI. ECLA PUBLICATIONS ON THE IRON AND STEEL SECTOR ISSUED DURING THE PAST THREE YEARS

The development of the iron and steel industry in Latin America, the problems entailed in its future expansion and the opportunitites for co-ordinating its prospective development with the aspiration for regional integration, all pointed to the need for a single document providing pertinent background data on this industry and, at the same time, an overall view of its economic and technical aspects for the information of Governments, planning agencies, iron and steel enterprises and international finance agencies.

La economía siderúrgica de América Latina (The Iron and Steel Economy of Latin America) (E/CN.12/727) was prepared for this purpose. The document, which has been favourably received by agencies and enterprises concerned in the iron and steel sector, served as the starting point for a series of separate supplementary publications in which some of the chief topics and problems emerging from the basic study are analysed and developed in greater detail.

Thus, the problems referred to in the document have been the subject of publications on current technology and the difficulties of applying it in the Latin American iron and steel industry, on problems requiring technological research, on export considered as a development project, and on economies of scale in the industry.

The document entitled La tecnología actual y los obstáculos a su incorporación en la industria siderúrgica latinoamericana (Modern technology and problems in its use in the Latin American Iron and Steel Industry) (ST/ECLA/Conf.23/L.34) undertakes an appraisal of the technological level attained in the Latin American iron and steel industry, the identification and assessment of the limiting factors and a discussion of current problems regarding the transfer of technical knowledge and likely ways of solving them.

The iron and steel industry in Latin America, as in other parts of the world where the raw materials and their reactions during the process of manufacture in iron and steel plants are not very generally understood, presents a series of problems calling for technological research. It was therefore necessary to investigate particular problems in the various iron and steel plants, classify those that are common to two or more and, lastly, to make suggestions as to the manner in which they might be dealt with. These topics are discussed in Problemas que requieren investigación tecnológica en la industria siderúrgica latinoamericana y reflexiones sobre la acción necessaria (Problems in the Latin American iron and steel industry requiring technological reasearch, and suggestions for the necessary action) (ST/ECLA/Conf.23/L.44).

Trade in iron and steel products between the countries of the region and the possibilities of trade expansion are analysed in La exportación como perspectiva del desarrollo siderúrgico latinoamericano (Exports as a factor for development of the Latin American iron and steel industry) (ST/ECLA/Conf.23/L.49).

Steel production in Latin America must steadily increase in order to keep pace with demand, but in most countries of the region, expansion is encountering serious obstacles, the chief of which is the lack of capital to set up new equipment. As the amount of capital absorbed by the integrated iron and steel industry is very substantial, maximum utilization of the advantages of larger-scale production and intensive application of advanced technology developed in recent years are essential factors in development. ECLA has therefore carried out a number of studies for the purpose of measuring, with a reasonable degree of accuracy, the effects of economies of scale, technological progress and new processes already developed industrially on investment and on production costs in hypothetical iron and steel plants of various annual production capacities. The methods applied in these studies also facilitate the collection of precedents useful for the consideration of specific cases, for which it would be sufficient to repeat the calculation, using the actual input costs for the location proposed.

Economies of scale in the iron and steel industry are dealt with in two documents. Economies of scale at small integrated steelworks (E/CN.12/764). deals with small installations with an annual production of 25,000, 50,000, 100,000, 200,000 or 300,000 tonnes of steel in rollings other than flats. The document describes the principal and auxiliary installations required in each of the cases examined and gives estimates of investment and production costs and manpower requirements.

The second paper, Las economías de escala en plantas siderúrgicas de tamaño medio y grande y la influencia de los adelantos tecnológicos en las inversiones y costos de producción (Economies of scale in large and medium-sized steelworks, and the effect of advanced techniques on investment and production costs) (E/CN.12/766), deals with plants of capacities between 100,000 and 2,500,000 tonnes a year which roll flat and non-flat products. This paper deals specifically with the effect of the application of advanced technology on plant and manpower productivity and on the reduction of specific consumption of certain raw materials and supplies of significant importance in operating costs.

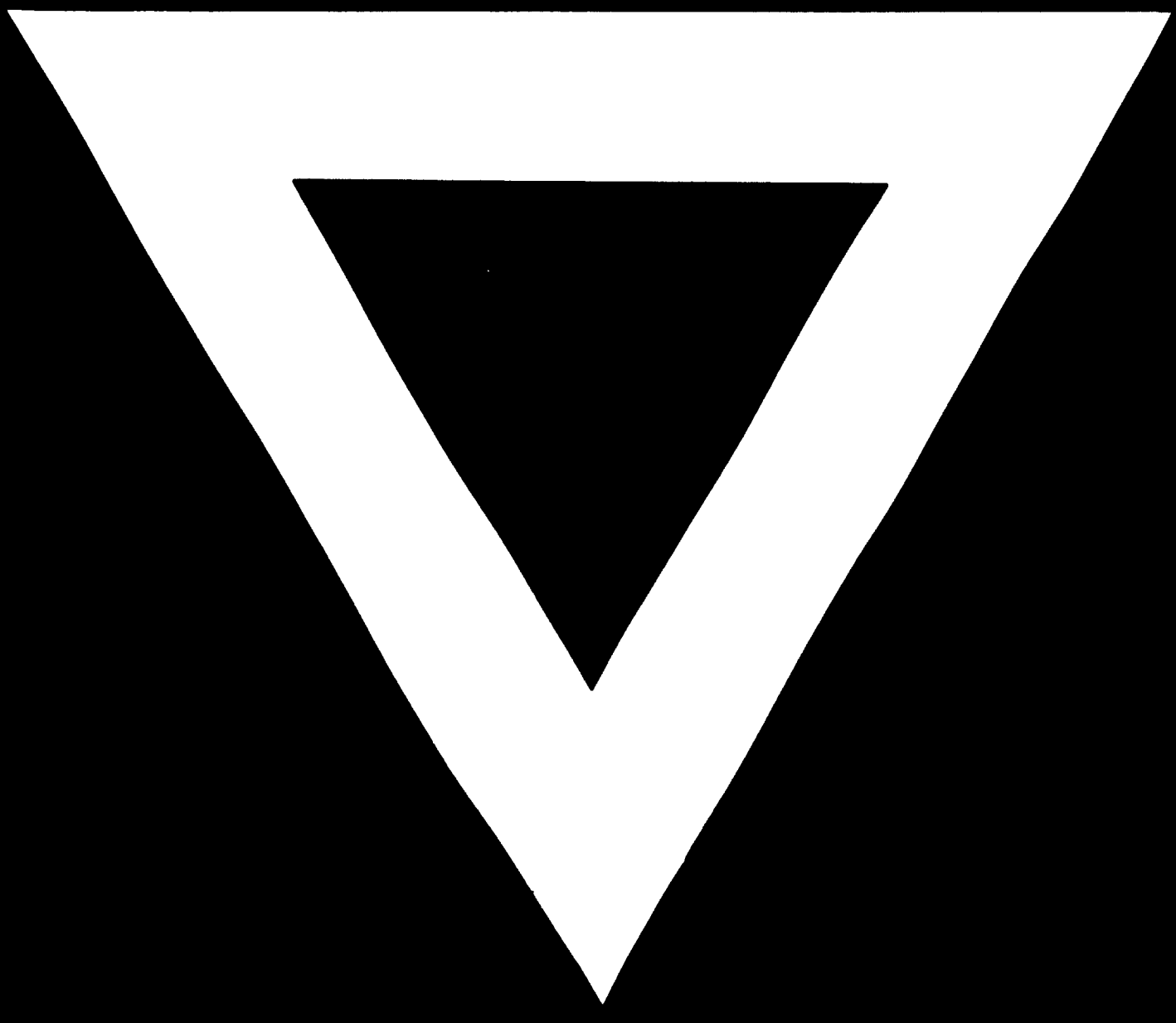
In Problemas que requiren investigación tecnológica en la industria siderúrgica latinoamericana y reflexiones sobre la acción necesaria, (ST/ECLA/Conf.23/L.44) the present situation regarding research in the iron and steel industry in Latin America is examined. Among suggestions put forward in this study is a proposal to set up a Latin American centre for metallurgical research, with special reference to the development of the region's steel industry. For this purpose, a document entitled Un centro latinoamericano para la investigación del fierro y del acero, (A Latin American centre for iron and steel research) has been prepared on the basis of this paper, setting forth definite proposals for dealing with the problem of technological research in the sector.

Publications in preparation

In preparation is a paper examining the possible opportunities for the relatively less developed countries of the region to set up their own iron and steel industries, in the form of integrated or semi-integrated plants or more limited installations using imported billets to produce bars and light steel profiles.

At the moment countries like Bolivia, Ecuador, Paraguay and the Central American States still have no iron and steel industry of their own and are contemplating some measure of development. The results of this study will be of special interest to them, in view of the modest scale of their market and the quantitative and qualitative limitations of their natural resources. It may be possible to devise a satisfactory scheme, within the framework of iron and steel integration agreements, that will enable the less developed countries to satisfy their reasonable and logical aspirations for a solution to their problems regarding the supply of various iron and steel products.

A number of options are open. For example the country could share in the financing of a new plant, which might be located there or elsewhere but which would have the function of serving the regional market; or a contribution might even be made towards the expansion of some of the existing plants for the purpose of supplying the regional market with iron and steel products. Or a small plant might be built by a country or a group of countries which would for a fairly long period be adequately protected against regional competition, until it was well established and able to hold its own on the same terms as the rest.



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