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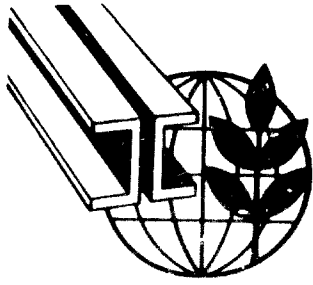
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PRESENT STATUS AND FUTURE OF THE IRON AND STEEL INDUSTRY
OF THE ASIAN COUNTRIES ^{1/}

by

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^{1/} The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. The document is presented as submitted by the author, without re-editing.

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I. INTRODUCTION

1. In 1966, the average per capita steel consumption in the ECAFE region (excluding mainland China) was about 49 kgs or about 28 per cent of the average world per capita steel consumption. In crude steel production, the share of the ECAFE countries (excluding mainland China) in the total world output in 1966 was about 1.3 per cent.

2. The predominant share of the ECAFE region in the total world production was contributed mainly by Japan (about 10 per cent) and to a small extent by India and Australia (combined about 2.5 per cent) - the three large steel producer countries in the region (mainland China excluded). The share of the other countries - small steel producers - was insignificant (less than 0.4 per cent).

3. On the basis of crude steel production, countries in the region may be divided into two groups (excluding mainland China) namely: (i) large steel producers (each with a production of over 1 million tons) and (ii) small steel producers (each with a production of less than 500,000 tons). Japan, India and Australia are the only countries in the first group. The remaining countries in the region fall in the second category.

4. Japan is the largest single steel producer in the ECAFE region, followed by India and Australia. It is the third largest steel producer in the world, outranked only by United States and the USSR. The country produced about 90 per cent of the total ECAFE steel production. About 98.5 per cent of the total crude steel production of about 53.7 million tons in 1965 and of about 61 million tons in 1966 was produced by these three large steel producers and the remaining 1.5 per cent by the small steel producer group.

5. Apart from the high level of production and consumption in the large steel producer countries, there was also a steady increase in crude steel production in the small steel producer group. Consumption per capita in this group during the period 1960-1966 increased about 20 per cent. In absolute

tonnage terms, consumption increased from 3.7 million tons in 1960 to 5.0 million tons in 1965, an increase of about 62 per cent. Production however has lagged far behind consumption. In 1960, production accounted for only about 9 per cent of consumption and in 1965 the proportion was about 13 per cent.

6. Excluding the three large steel producers, most of the countries in the region except Afghanistan, Cambodia, Laos, Nepal and a few others, possess steel works equipped mainly with electric arc furnaces, small open hearth furnaces and small rolling mills. These works however are characterized by their low productivity and efficiency. Furthermore, because of the shortage of raw materials (scrap), the capacities of electric smelters and open hearth furnaces are not fully utilized. The existing rolling mills in these countries, which have a total capacity about 1 million tons yearly are mostly dependent on imported semi and billets. In the past few years a degree of rationalization of the existing plants had been undertaken by the expansion and modernization of facilities. New integrated and semi-integrated plants are also under construction (Ceylon, Indonesia, Iran, Republic of Korea, Malaysia, New Zealand, Pakistan and the Philippines). These new plants and the structural changes being made in the industry as a whole will boost crude steel production to about 3 million tons in 1970. With other new plants at the implementation stage it is anticipated that crude steel production in 1970-75 will reach about 4.4 million tons.

7. The progress made so far in the iron and steel industry in the small steel producer countries has been small and, therefore, it has not had a significant impact on the general economic welfare of the large masses of people in the region. The most significant progress has been made particularly in Japan, and also in Australia and India. Although India's production in terms of per capita output seems insignificant, the percentage increase over the previous years has been considerable and has contributed much towards India's growing industrial potential.

II. APPARENT STEEL CONSUMPTION IN THE ECAFE REGION

8. The development of the apparent steel consumption in the ECAFE region (excluding mainland China) is shown in table 1. The average per capita steel consumption (excluding mainland China) rose from 35 kg in 1960 to about 49 kg in 1965, or an increase of about 40 per cent. However, the per capita steel consumption of the small producer countries of the ECAFE region was only 15 kg in 1965.

Table 1. Apparent consumption of crude steel in selected ECAFE countries in 1960 to 1965 (crude steel equivalent)

Countries	TOTAL (Thousand tons)					Per Capita Kilogrammes				
	1960	1962	1963	1964	1965	1960	1962	1963	1964	1965
A. Small Producers:	<u>3,753</u>	<u>4,184</u>	<u>5,086</u>	<u>5,576</u>	<u>6,020</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>14</u>	<u>15</u>
Burma ^{a/}	100	100	115	120	125	5	5	5	5	5
Ceylon	92	194	95	77	81	9	19	9	1	7
China (Taiwan)	289	330	397	483	626	27	29	34	40	50
Malaysia	195	273	249	334	367	28	37	33	43	46
Hong Kong	291	445	540	574	573	98	130	150	155	151
Indonesia	291	246	232	196	320	3	3	2	2	3
Iran	506	353	467	524	710	25	17	21	23	30
Korea, South	250	300	350	400	400	8	10	10	..	14
New Zealand	482	476	510	604	631	203	192	201	233	239
Pakistan	438	637	735	1,149	827	5	7	8	11	8
Philippines	425	390	594	684	765	15	13	20	27	24
Thailand	213	307	365	397	452	9	11	13	13	15
Viet-Nam, South	92	89	72	10	143	7	6	5	6	9
Others ^{b/}	..	..	..	24	..	..	..	..	..	..
B. Large Producers:	<u>28,189</u>	<u>33,021</u>	<u>36,251</u>	<u>43,630</u>	<u>42,202</u>	<u>53</u>	<u>60</u>	<u>64</u>	<u>75</u>	<u>71</u>
Australia	4,070	3,572	4,245	4,778	5,842	396	334	389	429	514
India	4,643	6,437	7,280	7,435	7,519	11	14	16	16	16
Japan	19,476	23,012	24,726	31,417	28,841	209	242	258	324	294
(A+B) Total ECAFE Region	<u>31,942</u>	<u>37,205</u>	<u>41,337</u>	<u>49,208</u>	<u>48,222</u>	<u>35</u>	<u>40</u>	<u>43</u>	<u>49</u>	<u>48.5</u>

Source: Statistical Yearbook UN 1966.
European Steel Market (ST/ECE/STEEL/12 UN 1965).

^{a/} Estimated.

^{b/} ECAFE countries excluding mainland China, North Korea and North Viet-Nam.

9. The per capita consumption in 1965 in the countries of the region varied widely being highest in Australia (514), Japan (294), New Zealand (239), followed by Hong Kong (151). The lowest was Indonesia (3 kg). In the other countries, it was as follows: India (16 kg), Pakistan (8 kg), Iran (30 kg), Philippines (24 kg), Thailand (15 kg), South Viet-Nam (9 kg) and China (Taiwan) (50 kg). With the exception of Australia, Japan and New Zealand, the per capita consumption in the other countries of the region was far below the world average per capita of 170 kg.

10. The apparent steel consumption in the ECAFE countries increased from 32 million tons in 1960 to 48 million tons in 1965, an increase of 16 million tons during the period. The share of the small steel producers and non steelproducer countries in this increased consumption was about 2.3 million tons, or about 14 per cent of the total increase. The large producer countries accounted about 14 million tons, or 86 per cent. Japan's share in this increased steel consumption during the period was 9 million tons, India's about 2.9 million tons and Australia's 1.7 million tons, or 56 per cent, 19 per cent and 11 per cent respectively. With the exception of Japan, Australia, New Zealand and Hong Kong, the per capita steel consumption in the other countries of the region in 1965 was far below the world average per capita of 170 kg for the same year.

III FUTURE STEEL DEMAND

11. The estimated apparent steel consumption in the small steel producer and non-steel producer countries in the ECAFE region in 1970 will be about 9.9-10 million tons, of which about 4.4 million tons will be supplied from domestic production and the balance of 5.6 million tons from imports. On this basis, a projection of the total steel consumption from 1970-1985 will be about 42 million to 45 million tons in 1985 for the less developed countries in the region.

12. The estimated apparent steel consumption for the ECAFE countries for 1970 may be ascertained from the following:

Large producer countries:

	<u>Million tons</u>
Japan	56
India	14
Australia	<u>7</u>
Sub-total	77

Small steel producers and non steel producer countries:

Production	4.4
Imports	<u>5.5</u>
Sub-total	9.9
Total apparent steel consumption	<u>87</u>

13. It is anticipated that the apparent steel consumption in the less developed countries after 1970 will be met substantially by home production of steel and by a moderate level of imports from the developed countries within and outside the region.

IV. ECAFE STEEL PRODUCTION^{1/}

14. Crude steel production in the ECAFE countries rose from 29.5 million in 1960 to 42.7 million tons in 1963, to 53.7 million tons in 1965 and to 61.19 million tons in 1966, an over-all increase of 24 million tons from 1960 to 1965 and of 31.7 million tons from 1960 to 1966. This represents an increase of about 82 per cent in the five year period (1960-1965) and 107 per cent in the six year period (1960-1966).

15. About 98.5 per cent of the total crude steel production in the ECAFE region was produced by the three large steel producers - Japan, India and Australia. The remaining 1.5 per cent was produced by a few small steel producers - principally China (Taiwan), Republic of Korea, New Zealand, Pakistan, Philippines, Singapore and Hong Kong.

16. The production and share of the ECAFE countries in the total world crude steel output from 1960 to 1966 are shown below:

	(Production in million tons)				
	1960	1963	1964	1965	1966
World	326	373	424	442	460
ECAFE countries	29.5	42.8	51.2	53.7	61.2
Per cent share ECAFE	8.5	11.0	12.0	12.0	13.0

17. The ECAFE region has ranked as the fourth largest steel producer in the world since 1964 up to the present. It is outranked by North America (USA and Canada); Western Europe (ECSC and UK) and Eastern Europe (USSR and

^{1/} Excluding mainland China, North Korea and North Viet-Nam.

other socialist countries). The largest single producer in the ECAFE region is Japan. It produces about 90 per cent of the total crude steel production in the region.

18. The growth of the iron and steel industry in Japan is one of the most remarkable developments in world steel industry. The country now ranks third in world crude steel production with a total output of 41.1 million tons in 1965 against 22.0 million tons in 1960 or an increase of 87 per cent. Japan produced in 1965 about 9.0 per cent of total world production. In 1966 crude steel production was about 47.8 million tons or about 10.4 per cent of the world steel production.

19. There was a considerable and steady increase in crude steel production in India from 1960 to 1965. The production was 3.3 million tons in 1960 which rose to almost 6.3 million tons in 1965, an increase of approximately 90 per cent. In 1966, crude steel production was 6.6 million tons. The production in 1965 was 1.48 of world output. In 1966, the production in India was 6.6 million tons or about 1.5 per cent of the total world production.

20. Crude steel production in Australia increased from 3.8 million tons in 1960 to 5.4 million tons in 1965 or an increase 42 per cent. In 1965, it was about 1.2 per cent of world production and in 1966 amounted to 5.8 million tons or about 1.3 per cent of the world production.

21. The increase in crude steel production of the ^{steel} small/producer countries in the region in terms of world production was insignificant. In 1960, the combined production of this group was about 336,000 tons; in 1963 it rose to about 600,000 tons; in 1965 to about 820,000 tons; and 1966 to about 1 million tons. Their combined production in 1965-1966 however was only about one per cent of the total crude steel production in the ECAFE region.

With the current expansion of steel capacity in some of these small producer countries, it is estimated that their combined total steel capacity will be about 3.5 to 4 million tons in 1970. Table I shows the crude steel production in the ECAFE countries^{1/} in 1960; 1963-1966.

Table II Crude Steel Production in Selected Countries
in ECAFE Region^{1/} from 1960; 1963-1966

ECAFE Countries	(Thousand tons)					% increase during period
	1960	1963	1964	1965	1966	
(A) <u>Small Steel Producers</u>	<u>336</u>	<u>594</u>	<u>676</u>	<u>820</u>	<u>1,010</u>	<u>200</u>
Burma		22	20	20	22	
China (Taiwan)	200	215	250	262	280	
Hong Kong	...	50	50	80	80	
Korea, Republic of	50	160	129	192	250	
New Zealand	...	50	60	88	100	
Pakistan	7	12	12	13	13	
Philippines	79	85	85	85	85	
Singapore	...	...	60	70	80	
Thailand	...	...	10	10	10	
(B) <u>Large Steel Producers</u>	<u>29,178</u>	<u>42,115</u>	<u>50,930</u>	<u>52,853</u>	<u>60,185</u>	<u>106</u>
Australia	3,753	4,644	5,099	5,400	5,800	
India	3,287	5,971	6,032	6,292	6,585	
Japan	22,138	31,500	39,799	41,161	47,800	
(C) <u>Total ECAFE Countries (A) + (B)</u>	<u>29,514</u>	<u>42,709</u>	<u>51,406</u>	<u>53,673</u>	<u>61,191</u>	<u>110</u>
<u>Per cent share ECAFE countries/world</u>	8.5	11.0	12.0	12.0	13.3	

Sources: UN Statistical Yearbook, 1965.
Annual Statistics British Iron and Steel Board, 1965.
Monthly Bulletin of Statistics, UN, May 1967.
Country Reports.

^{1/} Excluding Mainland China, North Korea and North Viet-Nam.

V. PIG IRON AND FERRO-ALLOYS PRODUCTION IN THE ECAFE REGION

23. Only Australia, India and Japan and to a small degree China (Taiwan), South Korea and Thailand, produced pig iron and ferro-alloys in the ECAFE region. In 1960, the total production in the region was about 20 million tons which rose to about 45 million tons in 1966. This represented an increase of about 25 million tons or about 125 per cent. Production in Australia correspondingly increased by about 54 per cent, India by 60 per cent and Japan by about 166 per cent.

24. Among the small steel producer countries only China (Taiwan) and South Korea and Thailand had iron making facilities. The output in 1960 of these three countries was 24,000 metric tons, 14,000 tons and 6,000 tons respectively. In 1966, iron production reached 72,000 metric tons in China (Taiwan) and 20,000 metric tons in South Korea, the level of production in Thailand remaining the same as in 1960.

25. In 1966, the total ECAFE pig iron production was about 13 per cent of world production against 8 per cent in 1960. Japan, with a production of 32 million tons in 1966, ranked third in world production of pig iron and was exceeded only by the United States and the Union of Soviet Socialist Republics. In 1966, India's share in the world output of iron was 2.2 per cent and Australia's share was 1.4 per cent.

26. The share of the smaller producers in the ECAFE countries in world output was very insignificant. Their output reached a total 44,000 tons in 1960 and 98,000 tons in 1966.

27. However, current plans in some of the smaller producer countries in the region - China (Taiwan), Indonesia, Iran, South Korea, Malaysia, New Zealand, Pakistan and Philippines - include the expansion of existing iron production facilities and/or the establishment and completion of new plants.

When all these new plants become operational, pig iron production in 1970-1975 will be about 3.0 million tons annually.

28. Table III shows the production of pig iron and ferro-alloys of selected countries.

Table III Production of pig iron and ferro-alloys (selected countries)
includes total production of pig iron and ferro-alloys; ^{1/}
direct castings are also included unless otherwise stated

(Thousand metric tons)

Regions and Countries	1960	1963	1964	1965	1966
<u>World</u>	<u>231,300</u>	<u>266,400</u>	<u>299,300</u>	<u>320,000</u>	<u>327,000</u>
<u>ECAFE Countries</u>					
of which:					
Australia	2,922	3,684	4,101	4,356	4,600
China (Taiwan)	24	71	62	72	72
India	4,260	6,744	6,741	7,033	7,140
Japan	12,341	20,436	24,450	28,161	32,743
Korea, South	14	6	6	18	20
Thailand	6	6	6	6	6
<u>Total ECAFE</u>	<u>19,546</u>	<u>30,947</u>	<u>35,370</u>	<u>39,646</u>	<u>44,581</u>
<u>% ECAFE/World</u>	8.4	11.7	11.8	12.4	13.0

Sources: United Nations Statistical Yearbook 1965 and UN Monthly Bulletin May 1967, Statistics for 1955-1962 inclusive - April 1963 for 1963-1964.

^{1/} Excluding mainland China

VI. AVAILABILITY OF RAW MATERIALS FOR IRON
AND STEEL MAKING IN THE ECAFE REGION

29. Abundant iron ore deposits exist in some countries in the region with varying characteristics and magnitude. The present reserve in India is estimated at 2,000 million tons. High grade iron ore deposits exist in all the states in Australia. Recent discoveries of high grade ores exceeding 8,000 million tons were found in the Pilbara region, Western Australia. The estimated potential reserves of high grade ores in Malaysia are estimated

at 50 million tons and in the Philippines the reserve is estimated at 95 million tons. Recent explorations and mineral surveys in Afghanistan, Burma, Thailand and Iran have indicated the existence of fairly large deposits of iron ores suitable for metallurgical use. As a whole, there are adequate sources of high grade iron ore for iron production in the ECAFE countries.

30. In addition there are about 2,000 million tons of complex ore (lateritic) deposits in the Philippines and over 500 million tons in Indonesia. Titaniferous magnetic sand reserves (iron sands) also abound in fairly large quantities in the Philippines and New Zealand. Beneficiation of these ores makes them suitable for the production of iron by special reduction processes. Large quantities of siliceous ores are found in Pakistan. One of the proposed steel plants will use beneficiated siliceous ore for iron production.

31. The recovery and sintering of fines and other beneficiation processes (pelletizing, prereduction, etc.) have improved the supply of raw materials for iron making. The improvements in ore ratio by the use of large blast furnaces and the technical innovations in iron making have reduced the quantity of ore per ton of iron production. Beneficiation plants are being set up in India and Australia for the production of pellets. A pelletizing plant was set up in the Philippines recently.

32. Large deposits of sub-bituminous and brown coals (lignite) are found in many countries of the region but coking coal for metallurgical purposes is in short supply or lacking in most countries. Deposits of coking coal are found in abundance in Australia and India. There are also fairly substantial coking coal deposits in Japan and Afghanistan, and to a limited extent in China (Taiwan) and the Philippines. Large quantities of limestone deposits exist in most of the countries of the region. Manganese ores are available in limited quantities in several countries - the Philippines, Iran, Japan. There are however considerable quantities of manganese ore deposits in India and Australia which are sufficient to meet the needs of the steel industry in these countries.

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33. The short supply of domestic scrap has become a serious problem in the small steel producer countries in the region, i.e. Pakistan, the Philippines and China (Taiwan). Japan, although a highly industrialized country, imports large quantities of scrap (about 3 million tons in 1966) yearly from the United States (90 per cent) and the balance from India and Australia. Though scrap may be imported by the small steel producers in the region, its purchase from abroad causes a severe drain of the foreign exchange reserves in these countries.

34. The potential reserves of iron ore and coking coal in the region as a whole would appear to be more than adequate to meet the raw material requirements of the existing steel plants and those contemplated for construction in the foreseeable future (not including Japan). Japan's supply of iron ore and coking coal will depend primarily on sources outside the region in addition to the supply from Australia, Goa (India), Malaysia and the Philippines.

35. Thus despite the lack of indigenous metallurgical coal in some of the small steel producer countries, new small-scale integrated iron and steel plants are being built or in the early stages of implementation (the Philippines, China (Taiwan) and the Republic of Korea) based on indigenous iron ores and imported coal (coke) or electric power for iron production. For imported coking coal, the most probable supply would be from Australia.

VII. PRESENT STATUS AND FUTURE PLANS OF THE IRON AND STEEL INDUSTRY IN THE INDIVIDUAL ECAFE COUNTRIES

36. The structure and characteristics of the iron and steel industry in the various countries in the region are briefly discussed below.

Afghanistan

37. There is at present no steel production facility in the country. Most of the steel requirements are met by imports. A plan to build an iron and steel industry has been under consideration by the Government.

Australia

38. Australia ranks as the third^{1/} major steel producer in the ECAFE region and fourteenth in world steel production. In the ECAFE region, Australia is outranked in steel production by Japan, mainland China and India. Iron and steel in the country are mainly produced by the Broken Hill Proprietary Limited (BHP) and its subsidiary companies. In 1964, 1965 and 1966, crude steel production was about 5 million, 5.4 million and 5.8 million tons, or an increase of 9%, 17% and 26% respectively over the production of 1963. The increase in production during the last three years was principally due to the major plant expansion programmes undertaken by BHP in the early sixties which have been continuing at a high level up to the present^{2/}.

Major steel works

39. The structure and production capacities of the BHP group are as follow:

(1) Port Kembla (NSW): The integrated steel works with four blast furnaces and 13 open hearths has a capacity of 3.3 million tons of steel ingots. Its present plate and hot strip mill capacity is 2 million tons per annum and is being raised to 4.5 million tons, by addition of a second mill, in 1968.

(2) New Castle NSW : Integrated steelworks at Newcastle have an annual capacity of 1.8 million tons. The plant consists of four blast furnaces, six open hearths and two basic oxygen steelmaking furnaces. Extension to the plant includes a 50-ton oxygen converter with a four-strand continuous casting plant and new precision merchant bar mill.

(3) Whyalla SA: has an integrated steelworks with an annual capacity of 0.9 million tons. Plant comprises two blast furnaces, two basic oxygen steelmaking furnaces, a rolling mill and a universal wide flange beam mill.

(4) Kwinana WA : Merchant mill and fence post plant. It includes a blast furnace with an annual capacity of 600,000 tons.

^{1/} Excluding China (mainland)

^{2/} Developments in Australian Manufacturing Industry 1964-65, Department of Trade and Industr , Commonwealth of Australia.

(5) Commonwealth Steel Co. Ltd., (subsidiary of BHP) NSW : Special steel forging and steel castings.

BHP Subsidiary companies and other steel manufacturers

40. In addition to the main BHP group, BHP has also subsidiary companies which engage primarily in the manufacture of special and alloy steels (Commonwealth Steel Ltd.); manufacture of wire products (Australian Wire Industries Pty. Ltd) and the production of ferro-alloys (Tasmania Electro Metallurgical Co.).

41. There are also other steel manufactures in Australia which are engaged in the production of special steel products, i.e. electric steel (John Lysaght Australia Ltd.) and a few small steel making enterprises producing ferrous pipes and tubes, steel castings, malleable pipe fittings etc.

Burma

42. The only steel plant in the country was built in 1957, and it has been in operation since then.

The present production facilities consist of:

1 - 12 ton electric furnace with annual production capacity of 22,000 ingot tons.

1 - rolling mill with a capacity of 40,000 tons of merchant bars and small slabs.

1 - sheet mill with an annual production capacity of 8,000 tons.

1 - galvanizing plant.

1 - wire products plant for the manufacture of barbed wire and nails.

43. Due to the shortage of domestic scrap, ingot production has been low. To provide continuity of operation of the furnace and the rolling mills, scrap and billets are being imported.

44. There are plans at present to develop the iron and steel industry in the country. A government board has recently been created to draw up

a comprehensive scheme for setting up additional iron and steel plants at suitable sites in the country.

Cambodia

38. There is no basic iron and steel industry at present in the country. The establishment of an iron and steel plant has been under consideration during the last few years.

Ceylon

39. The first stage of the iron and steel project of the Ceylon Steel Corporation has recently commenced production. The equipment of the plant consists mainly of a billet reheating furnace, a rolling mill including a wire drawing mill and wire products shop.

40. Annual production capacity of the rolling mill is estimated at 60,000 tons operating on a double shift basis and 100,000 tons on a three shift basis. Imported billets will be used in this stage.

41. The second and third stages envisage the installation of steel smelting and iron making facilities using indigenous ores and imported raw materials (coals). A techno-economic feasibility study for these next two stages is under preparation by a foreign consulting firm. It is anticipated that about 60,000 - 100,000 tons of mild steel merchant bar products will be produced in 1970-75.

China (Taiwan)

42. There are more than 90 steel mills registered as members of Taiwan Steel Industry Association. Most of them are small re-rollers. Their products are chiefly small bars and shapes. Total installed capacity at present is estimated at 350,000 tons a year for steel making and 600,000

tons a year for hot rolling. Most of the steel is made by melting scrap, mainly imported, in electric arc furnaces and subsequently processing through small rolling mills. Billets, wire rods, skelp and base plates are also imported for further processing into wire products, pipes, galvanized sheets and hot dipped tinplates.

Iron production

50. As of 1966, Iron production facilities consisted of 2 blast furnaces with an aggregate annual capacity of 25,000 tons and 30 electric smelter with annual capacity of 90,000 tons. The total production in 1966 was 72,000 tons.

Crude steel production

51. Production in 1966 reached about 280,000 tons or about 27 per cent larger than in 1963. There are 20 arc furnaces and 2 oxygen converters.

Rolled products

52. There are about 88 rolling mills with a total installed capacity of about 600,000 tons per annum. In 1966, 440,000 tons of finished products were produced.

The proposed integrated iron and steel plant

53. The proposed integrated plant will be built in two stages. Backward integration is proposed.

Stage 1. Construction 1967-1971

Rolling mills only.

54. Installation of primary hot strip reversing and cold rolling mills with ancillary equipment, soaking pits, annealing furnaces, cleaning lines,

etc. 435,000 tons of plates, hot and cold rolled sheets, billets, tin plates etc. will be produced.

Slabs and blooms will be imported in this stage.

Stage II. Construction 1971-1975.

49. Installation of blast furnaces, LD converters and continuous casting machine. A raw material beneficiation plant for iron ores will be set up. Coking coal and iron ore will be imported. 848,000 tons of plates, hot & cold rolled sheets, tin plates, billets etc. will be produced per annum.

Hong Kong^{1/}

50. Hong Kong remains one of the world's largest shipbreaking centres. The rolling mills are principally dependent on scrap derived from the ship-breaking industry.

The four leading steel producers in the country are:

- (1) Shin Wing Co. Ltd.
- (2) Shun Fund Iron Works
- (3) Chiap Hua Iron and Steel Works
- (4) Fuji Marden Company.

51. In all there are about 17 steel rolling mills of varying sizes in Hong Kong, most of which are also engaged in shipbreaking. The annual production capacity of all the mills is about 400,000 tons.

India

52. The product range of the public sector plants is more or less limited to specialized items, while those in the private sector cover a wider variety

^{1/} Heavy Industry in Hong Kong, Kong Kong trade bulletin, April 1967.

of products. The Bhilai plant was designed primarily for the production of heavy structurals and rails; the Durgapur, of light structurals and railway material; and the Rourkela, of flat products - sheets and plates. The product mix in the private sector plants (TISCO and IISCO) ranges from heavy and light sections, to flats and merchant bars. These five steel works are the main steel producers in the country. They have been laid out as fully integrated installations.

59. There are also about ten secondary private steel producers in the country. Their aggregate annual crude steel output amounted to about 60,000 tons in 1963 all of which was produced in electric arc furnaces.

60. The third five-year plan (1961-1966) set a production target of 10.2 million ingot tons of steel and 1.5 million tons of saleable pig iron. This programme was to be met by:

(1) The expansion of the three plants in the public sector viz: Bhilai to 2.5 million tons; Rourkela to 1.8 million tons and Durgapur to 1.6 million tons and

(2) A balancing scheme to increase production of the two private major plants viz: the Indian Iron and Steel Co. by 0.3 million tons and Tata Iron and Steel Co. to 2 million tons.

(3) The construction of a large new integrated steel plant - Bokaro and the production of pig iron based on a low shaft furnace technique with the use of lignite coke at Neyveli.

61. Implementation of this expansion programme was undertaken but the production targets envisaged were not achieved during the plan period. The iron and steel production for 1963 to 1966 are shown below:

Year	(Thousand Tons)	
	Iron Production	Ingot Steel Production
1963	6,149	5,971
1964	6,533	6,032
1965	7,033	6,392
1966	7,140	6,585

62. Plans are now being considered to produce 14 million ingot tons in the fourth plan period.

Indonesia

63. There are no iron and steel plants except a small rerolling mill with an annual capacity of 10,000 tons in Djakarta, a sheet galvanizing plant and several iron and steel foundries for engineering shops.

64. Exploration works have been carried out on the ore deposits in Lampung, Djampang Kulon, Pleihari and Meratus Mountain. More systematic and detailed exploration works were later on continued in the region of Kalimantan.

65. It has been found that Indonesian coals do not have good coking quality.

66. The following was the programme according to the eight year plan.

1. Pig iron manufacturing facilities consisting of a lowshaft furnace with an annual capacity of 35,000 tons in Lampung.
2. A steel work in Tjilegon having a capacity of 80,000 tons rolled product consisting of open hearth steel melting shop, merchant mills and wire drawing facilities.
3. A survey project on the possibility of erecting an integrated iron and steel plant in South East Kalimantan with an initial capacity of 250,000 tons annually.

67. Work on the foregoing projects could not be continued. About

200,000 tons of merchant bars, pipes, sheets and plates are imported annually.

Iran

68. In October 1965, an agreement was initiated for economic and technical co-operation between Iran and the USSR. The agreement included the establishment of a steel mill together with a machine tool building plant against the sale of natural gas (a pipe line will be constructed for this purpose) to the Soviet Union.

69. The mill will be built in two stages. The first stage (1966-1969) envisages the production of about 500,000-600,000 tons per annum of crude steel and, upon the completion of the second stage (1970-1971), the total annual production will be about 1.2 million ingot tons. The USSR will undertake the delivery of all the machinery equipment of the steel mill, as well as the machinery and equipment for the development of the BAFT Iron Mines and the Kerman Coal Mines. The USSR will also provide the necessary key personnel to assist in the construction, installation and the initial operation of the mill. The design and plant layout will also be undertaken by the USSR.

70. The Iranian Steel Corporation (National Steel Corporation) and other Iranian agencies will undertake the development of limestone and fire clay quarries; the construction of buildings for the plant and infrastructures for the supply of power, railroad, water, etc.

71. The first stage of the steel project is estimated to cost 2,200 million rials (US\$300 million). Payment will be made by the sale of natural gas to the USSR. About 300,000 tons of steel products which will be manufactured in the first phase of the project will be used for the construction of machinery and equipment in the machine tool building plant and the balance will be used to meet the requirements of the oil, mining and engineering

industries in the country.

72. Apart from the USSR-Iran steel project, the National Iranian Rolling Ltd., a private company, is currently building two steel plants, viz: (1) A merchant bar mill with a production capacity of about 65,000 tons yearly consisting of round bars, squares and small sections. (2) A wire products plant with an estimated yearly capacity of about 85,000 tons. Completion of construction is expected in 1968. These plants are located in Ahwaz. In addition, plans are now being made for the construction of a strip and pipe mill. Completion is anticipated in 1969.

Japan

73. Japan has maintained its position as the third largest steel producer in the world. In 1967 crude steel production was 63.9 million tons.

74. The remarkable progress made by Japan in the post war development of the iron and steel industry can be attributed to (i) the progressively sound economic growth of the country as a whole and (ii) the vigorous programme undertaken for the rationalization of the steel industry, which started in the early fifties.

75. Ultra modern integrated iron and steel complexes are located in coastal/reclaimed areas with built-in deep harbours and modern port facilities. These modern port facilities were designed to accommodate supertankers and large ore and coal bulk carriers which transport raw materials from overseas to the various steel works.

76. For iron production, the mammoth blast furnaces equipped with computer devices ranging from 3,000-4,000 tons/d were built to provide the large quantities of hot metal (pig iron) for steel making in large capacity oxygen top blown (LD) computer controlled converters (150-200 t/ch).

77. In the rolling mill sector, the significant features were the installation of high production continuous hot strip and cold mills equipped with electronic and automatic gauge controls for more precise control of thickness and quality of finished products. These mills are also equipped with the latest type of associated equipment (cleaning, pickling, annealing, shearing) and finishing units, i.e. continuous galvanizing and electrolytic tinning lines.

78. The rationalization of production equipment and facilities, the intensification of raw material preparation, the application of the advances made in steel technology and the introduction of computer controls in iron and steel making and in rolling operations have resulted in higher productivity, lowered production costs and improved the quality of iron and steel products produced in the country.

79. The iron and steel productions for 1960 and 1963 to 1966 are shown below:

Year	Pig Iron	Crude Steel	(Thousand tons)	
			Rolled Ordinary Steel	Products Special Steel
1960	11,896	22,138	15,675	1,169
1963	19,936	31,501	22,649	2,309
1964	23,778	39,799	28,606	2,532
1965	27,502	41,162	30,033	2,411
1966	32,018	47,784	34,637	3,196

80. Crude steel production is estimated to reach 65-70 million tons in 1970. This will be met not only by the expansion of existing steel works but also by the anticipated production from the three new steel works now under construction and the proposed new integrated steel plants including Kakogawa Works of Kobe, Kashima Works of Sumitomo, Orito Works of Fuji.

Korea, Republic of

11. There are about 50 small iron and steel plants in the country. Most of these plants are very old, ill equipped and non productive. Since 1963, however, the industry has been undergoing a certain degree of rationalization. Modernization and/or expansion of some of the the existing facilities have taken place or are in progress.

The construction of a new iron production plant (Inchon Iron Works) with a capacity of about 300,000 tons of iron annually was started in 1965. Completion of the installation is expected in 1968. The Government has also formulated plans to set up a new integrated iron and steel plant on the east coast of the country.

It is anticipated that, with the modernization and expansion of existing steel facilities together with the completion of the new steel projects now being undertaken, crude steel production in the country in 1970 will increase to about 500,000 tons annually. Future structural changes contemplated in the industry will further raise steel production to about 1 million tons in 1975.

Crude steel production^{1/}

12. Crude steel production in 1966 was about 250,000 tons^{2/}. Open hearth steel accounted for about 93,000 tons, acid converter steel for about 106,000 tons and electric arc furnace for about 20,000 tons of steel capacity in 1964.

Pig iron

13. The combined annual capacity of pig iron plants is estimated at 100,000 tons. As of 1966, however, the annual pig iron production in the country has reached only about 21,000 tons.

^{1/} Economic Statistics Yearbook 1966, Research Dept. Bank of Korea.

^{2/} Economic Survey 1966, Economic Planning Board, Republic of Korea.

Rolling mills

86. As of 1964, there were 44 enterprises with rolling facilities for the production of rolled products, i.e. billets, sheets, merchant bars and wire rods. Most of these producers are rerollers. The largest producer is the Inchon Heavy Industry with a capacity of 100,000 tons per annum. The production of the other mills consisted mainly of round bars and small sections ranging from 3,000 tons to 10,000 tons per annum.

New plants and expansion programmes

Ulsan integrated works

87. This plant will be built by the Government as an integrated iron and steel works which will produce ultimately about one million tons of slabs, large and medium sections and flat products.

Union Steel Mfg. Co., Ltd.^{1/}

88. The existing plant facilities consist mainly of a 4-high reversible cold rolling mill with a production capacity of about 100,000 tons per annum. An expansion programme is now being undertaken.

89. A plate mill with a capacity of 100,000 tons is being planned and a new cold rolling mill of 45,000 tons capacity is under construction.

Inchon Iron Works^{2/}

90. This new plant is under construction. It will be built in two stages.

91. Construction is expected to be completed in 1969-1970. The ultimate over-all production will be:

Sponge iron	- 250,000
Pig iron	- 125,000
Crude steel	- 350,000
Billets	- 100,000
Hot strip	- 100,000

1/ Report Union Steel Manufacturing Co. Ltd. February
Yawata Iron and Steel March 1967.

2/ Inchon Iron Works Report - March 1967.

Hot metal from the works will be used for the O.H. furnaces of the Inchon Heavy Industry which is located nearby the premises of the plant.

Inchon heavy industry

93. The facilities of the existing plant consist of: a blooming mill, with an installed rolling capacity of about 100,000 tons per annum; an open hearth furnace with a melting capacity of about 70,000 tons per annum and a section mill of about 42,000 for medium sections and 40,000 tons small shapes per annum, a sheet mill with a capacity of about 5,000 tons of wide sheets per annum, and a merchant bar mill of about 80,000 tons per annum.

94. At present actual production is well below the above capacities due to the lack of hot metal feed for the open hearth furnace. Improvements are now being made in the existing furnace to increase crude steel production to about 100,000 tons per annum.

Malaysia

Integrated iron and steel plant, Malayawata Steel Ltd.

94. The integrated iron and steel plant at Prai began operation in August 1967. It has the following equipment:

Sintering plant	260t/d DL type
Blast furnace (charcoal feed)	170t/d
L.D. vessels, two, 15 ton. and rolling mills	

The capacity of the plant is 65,000 tons ingots per year.

95. A second similar blast furnace may be installed within two years. The crude steel output will then increase to 120,900 tons per year. Additional facilities will include rolling mills of 111,000 t/a capacity.

96. The products will consist mainly of round and deformed bars, angles, channels and small flats.

United Malaysian Steel Mills

97. United Malaysian Steel Mills at Kuala Lumpur will have an output of 2,000/3,000 tons per month.

Other plants

98. The following other plants also operate:

- (1) Three sheet galvanizing plants with total capacity of 48,000 tons per year.
- (2) Three pipe mills with total capacity of 12,000 tons per year of spiral pipes.
- (3) Ten manufacturers of weld mesh.
- (4) Twenty four producers of wire and wire products.

New Zealand^{1/}

99. The only existing steel works in the country at present is a merchant bar mill with an electric melt shop. It was built by the Pacific Steel Ltd. in 1962. Local scrap is used for the production of crude steel.

100. The rolling mill consists of a breakdown mill and an eleven stand finishing mill with an annual production capacity of about 120,000 tons of merchant sections on a 3 shaft basis. The electric arc furnace has a capacity of about 80,000-100,000 tons per annum.

101. The plant will be expanded to produce 120,000 tons of merchant bars from ingots produced in the melt shop and from billets which will be supplied by the new integrated steel works (described below) of the New Zealand Steel Co., Ltd., which is under construction. The manufacture of wire rods is also envisaged in this expansion programme. Billets for this purpose will also be supplied by the new integrated steel works.

1/ Country Sources - New Zealand

102. Other plants existing since 1963, are: (i) a wire drawing mill using imported wire rods with a capacity of about 40,000 tons per annum; and (ii) a wire ropery with an annual output of about 3,000 tons of round strand wire from 1/8" to 1/4" diameter.

New Zealand Steel Co., Ltd.

103. In 1965, the New Zealand Steel Co., Ltd. with a new Board of Directors, launched the building of the first integrated iron and steel work in the country.^{1/} The Waikū near Auckland was chosen as the plant site.

104. Construction of the first stage of the plant is now in progress.^{2/}

The structure of this stage is outlined below:

- (1) Type of installation - semi-integrated.
- (2) Smelting:
 - (i) Special reduction process.
 - (ii) Capacity - 200,000 tons per annum (sponge iron).
 - (iii) Source of iron ore, Beachsands.
 - (iv) Fuel and power - New Zealand coal and steam generated electricity from government distribution.
 - (v) Raw material preparation - Magnetic concentration, pelletizing for the production of sponge iron.
- (3) Steel making:
 - (i) Electric arc furnace - two electric arc furnaces with a combined capacity of about 180,000 tons yearly.
 - (ii) Continuous casting machine (billets).
- (4) Rolling:
 - (i) No rolling mills.
 - (ii) Galvanized sheet and flats from imported cold rolled strip 100,000 tons per year. Finished material - corrugated and flats in cut lengths.

^{1/} New Zealand Investigating Co. Report 1963.

^{2/} Report New Zealand Steel Ltd. - March 1967

Expansion plans

109. Stage II. Expansion of billet production and installation of pipe mill using imported skelp.

Stage III. Expansion of steel making plant with the addition of a third furnace adding 60,000 tons per year as continuous cast billets and installation of cold strip mill and associated equipment.

Stage IV. Addition of a hot strip mill and electric melting facility and section mill to produce hot bands and shapes with an anticipated total production of approximately 600,000 tons per year.

Nepal

100. There is no steel plant in Nepal. A plan is under consideration by the Government for the building of a small steel plant near Kathmandu. Coke for iron production will be imported from India.

Pakistan

107. Before 1967, crude steel was mainly produced from several electric arc furnaces with a total capacity of about 20,000 tons per annum. Actual production however was only about 12,000 tons yearly. A semi-integrated steel plant at Chittagong, East Pakistan has recently commenced production. The new plant produces 150,000 tons of finished products yearly. Raw materials are imported scrap and pig iron.^{1/}

108. At present four steel projects are under active consideration by the Government, viz:

(1) Integrated Steel Works at Karachi, West Pakistan^{2/} This project is a joint undertaking between the Industrial Managements Ltd. (a private

^{1/} Bangkok Post 26 August 1967.

^{2/} Press Communique Government of Pakistan - "Business Post" 20 April 1967.
Country Report - April 1967.

Report, West Pakistan Industrial Development Corporation, April 1967.

firm in Karachi) and the West Pakistan Industrial Development Corporation (WIDC). Raw materials will be imported iron ore and coke. Annual production capacity will be about 530,000 tons of finished products and 100,000 tons of foundry pig iron.

(2) Integrated Steel Works - This project is sponsored by the West Pakistan Industrial Development Corporation. Annual steel production capacity will be approximately 500,000 tons. The proposed location of the plant is Kalabagh, in the northern part of West Pakistan. The plant will use the indigenous siliceous ores of the Chichali area and imported coke.

(3) Semi-Integrated Steel Works at Karachi, West Pakistan. This plant will be set up the National Steel of Pakistan Ltd., a private corporation. Raw materials will consist of imported scrap and pig iron. Estimated production capacity will be about 500,000 tons of finished products per annum.

(4) Expansion of the East Industrial Development Corporation (EIDC). The semi-integrated steel plant at Chittagong East Pakistan will ultimately have a production of about 250,000 tons of finished products per annum.

Other steel plants

109. There are about 120-130 rerollers in the country using heavy scrap and imported billets for the manufacture of ordinary bars and rods. Their rolling capacity is about 100,000-120,000 annually. Due to the shortage of the supply of these materials, many of these rerollers remain idle or operate at very low capacities during the year. Shortage of foreign exchange and the high cost of imported billets has been a serious handicap in maintaining continued operations of most of these plants.

A wire rod mill with an annual capacity of about 10,000 tons annually and a hoop mill of 6,000 tons capacity yearly is under construction at Karachi. A plant to produce welded pipes of about 10,000 tons per annum is also under construction at Dacca. Similar plants are in the process of construction at Lahore and Karachi. There are also two existing wire rods mills with an aggregate annual capacity of 15,000 tons.

Philippines^{1/}

Crude steel production

110. At present there are five steel works in the country producing ingots from scrap, with a combined installed capacity of about 150,000-200,000 tons annually.

111. Their actual combined crude steel production during the last few years was only about 80,000-90,000 tons yearly. This low production was due to the short supply of scrap, because of the depletion of scrap derived from war surplus equipment and sunken ships.

Rolled products

112. The rolled steel products produced in the country consist mainly of small bars and shapes and wire rods.

113. There are five ingot rolling mills and three rerollers with an aggregate installed rolling mill capacity of about 360,000 tons per annum for the production of merchant bars and small shapes. One of the ingot mills has a built-in finishing mill for the manufacture of wire rods with a capacity of about 40,000 tons yearly.

114. The rerollers use imported billets and the ingot mill operators also import billets to supplement the inadequate production of ingots in their own plants. The shortage of scrap and short supply of imported billets is reflected in the low production in these various mills. Most of these rolling mills operate only at about 50 per cent of their installed capacity.

115. There is at present one cold rolling mill in the Philippines with an installed capacity of about 120,000 tons per annum. Hot rolled coils are

^{1/} Country Sources - Philippines. Presidential Economic Staff, 1966.
Report of the Iron and Steel Survey Mission, AIDC - 1967

imported. Production is low due to the short supply of imported hot rolled coils.

116. In addition to the steel works and merchant bar mills, there are also a few facilities in the country for galvanizing and tinning of sheets, and the manufacture of pipes and tubes.

117. The structure of the new plant under construction is described briefly below.

Integrated iron and steel works

118. The plant will be built in 2 stages. The rolling mills will be completed in first stage. Iron and steel making units will be erected in the second stage. The first stage will be completed in 1968 and the second in 1970-71.

119. The steel works have been designed primarily as a flat products plant which will produce hot rolled coils, cold rolled and tin sheets, strip and plates for domestic consumption. Plates for the local shipbuilding and ship repair industry will also be produced. The plant will have an initial annual production of 430,000 tons of finished products. The plant has been designed for an ultimate capacity of one million tons per year of finished product.

120. In the first stage operations, semis materials such as hot rolled sheet, blooms and slabs will be imported for rolling into finished flat products.

121. The Government has for several years been formulating plans for the exploitation of the huge deposits of nickel laterite ores (200 million tons) in Mindanao Island, Southern Philippines with a Fe content of about 45 per cent and nickel of about 0.8 per cent.

122. Recently international tenders were called by the Government for the

exploitation of these ores for the recovery of nickel and its by-product - metallic iron - for steel production. It is planned to set up a plant which will produce annually about 6,500 tons of ferro nickel and 250,000 tons of billets.

Singapore^{1/}

123. The steel industry of Singapore consists of a few small plants specializing mainly in the production of merchant bars, pipes and tubes. The structures of some of them are described below:

National Iron and Steel Mill Ltd. (NISM)

124. The National Iron and Steel Mill Ltd., was organized along with the National Shipbreakers Ltd., and the Eastern Industries Ltd. The ship-breaking company was formed to engage in shipbreaking to supply scrap for the steel plant and the rerolling mill. Eastern Industries was formed to engage in the recovery of the tin contents from discarded metal containers and to use the detinned containers as scrap for the melt shop.

125. The plant was established at the Jurong Industrial Estate. The production was 62,852 tons in 1966. There are plans to expand production to 250,000 tons/annum.

126. Economic Development Board (E.D.B.) is also seriously considering the installation of an integrated iron and steel mill in Jurong Estate with a capacity of not less than one million tons per annum. This integrated mill will eventually have one or two blast furnaces, LD converters and a few rolling mills of large capacity.

^{1/} Country Sources - Singapore April 1967.

Malayan Iron and Steel Mills Ltd.

127. This firm has a similar set up to the NISM but on a smaller scale. It produces mainly round and flat bars. Its capacity is about 6,000 tons per annum. Current plans envisage an expansion to double the capacity of the plant in the next few years.

128. In addition to these two establishments there are nine other small rerolling mills producing small bars and flats and plants manufacturing pipes, welded pipes, etc.

Thailand

129. Pig iron and steel are manufactured by the Siam Iron and Steel Co. The facilities located at Tha Luang, Saraburi province consist of 3 small charcoal blast furnaces, of 20 T/day capacity each, a small open hearth furnace, 3 high frequency induction furnaces, and a 5 ton arc furnace. Total annual output of crude steel is 20,000 tons. About 10,000 tons of merchant bars are produced annually.

130. There are also plans to exploit and develop a newly discovered high grade ore deposit of about 7 millions tons in the Khao Tap Kwai area, Lopburi province, about 160 km from Bangkok. The proposed integrated plant will be located between Bangkok and Samud Prakarn on the Phrapradaeng side of the Chao Phya river. Iron production of about 400 tons/day is envisaged. Finished product output will be 150,000 tons/year.

131. Another steel plant is being set up by the G.S. Steel Company Ltd., at Samud Prakarn, Crude steel will be produced by two 20-ton electric arc furnaces mainly from imported scrap. Initially 96,000 tons/year of straight or coiled rounds will be produced, rising in 1969 with the installation of

third fee., to 130,000 tons.

132. Particulars of other plants are given below:

- a) Two tube and pipe plants, producing 15,000 tons per year of welded, galvanized pipes.
- b) Three sheet galvanizing plants producing 120,000 tons/year from imported raw materials.
- c) Hot dipped tinplate is being produced at 10,000 tons/year from imported Japanese blacksheets by Thai Tinplate Co.
- d) There are also several rerolling mills and numerous small foundries.

VIII. Problems retarding the development of the steel industry in ECAFE countries

133. Some of the inhibiting factors and problems that are being faced by the smaller countries in the region in connexion with their long range development plans and programmes for the establishment of new steel plants and/or expanding and modernizing the existing iron and steel production facilities are given below:

134. (1) Lack of adequate domestic capital: The capital outlay required for even a simple merchant bar mill with its complementary iron and steel making production sectors is comparatively large. The establishment of an integrated steel plant equipped with blast furnaces, LD converters and flat products primary and finishing mills for cold rolling tempering, etc., and with associated galvanizing and electrolytic lines for flat products (300,000 tons yearly) will cost very much more. The upward trend in the cost of investment makes it difficult to raise the necessary capital funds to implement steel development plans. For this reason, the implementation of many of the steel development plans in these countries has been delayed.

135. (2) Lack of markets: The demand for steel in some of these countries is relatively small. Iron and steel mills supplying large markets may justify the use of mass production techniques and the use of specialized machinery. This also results in the full utilization of infrastructural facilities. The advantages of large scale operation are highly significant in a capital intensive industry such as the iron and steel industry.

136. (3) Lack of trained personnel: There is a lack of properly trained personnel, skilled workmen and supervisory personnel at the operation levels, as well as in the higher echelons of management, in many of the smaller countries in the region. Most of the new steel works being established or under consideration may be located in rural areas where skilled personnel are critically insufficient. Steel technicians of any worth can be produced only by long practical experience. The training of personnel is an expensive process.

137. (4) Lack of raw materials: Except for Australia and India, most of the other countries of the region will, to a greater or less degree, meet difficulties in obtaining the full complement of indigenous raw materials required for the operation of iron and steel works. The lack of good coking coal in many of these

countries has deterred the installation of pig iron production facilities in some of the proposed steel works, i.e. Pakistan and the Philippines. The supply and quality of ores in some areas are inadequate for iron making. The various types of beneficiation and agglomeration process for low grade iron ores may solve the inadequacy of good grade ores in some of the countries. Taking the region as a whole, there is an adequate supply of raw materials for iron and steel making to meet the requirements of the steel industry in the foreseeable future. Japan may obtain its requirements of raw materials from countries within and outside the region.

138. (5) Lack of scrap: The scrap available or generated in most of these countries is limited due to the low level of steel consumption. The use of the oxygen top blown process (LD) reduces the scrap tonnage required for steel making.

139. (6) High cost of transportation: The lack of adequate and suitable transportation facilities on land or at sea poses a serious difficulty in the movement of raw materials and supplies needed by the steel works. This problem will seriously affect operational efficiency of the steel works contemplated in the long range steel development plans in some of the countries in the region.

IX. INTRAREGIONAL AND INTERREGIONAL COOPERATION

140. Many countries both from outside and within the region have assisted the developing countries of ECAFE in the planning and development of their iron and steel industries. Details of such cooperation and assistance are briefly indicated below:

141. Many foreign experts have assisted in the geological investigation and the exploration of the mineral resources in Afghanistan. The USSR has been assisting Ceylon in the establishment of its iron and steel plant. Many feasibility studies have been made by foreign consulting firms for the development of the steel industry in China (Taiwan). Assistance from outside is expected for financing the US\$200 million integrated steel project. In India, the Bhilai plant was constructed with the technical and financial assistance of the Soviet Union; the Durgapur plant was constructed by a consortium of United Kingdom Companies and the Kourkela plant was built with technical and financial assistance of West German firms. The new integrated Bokaro plant is being built with the technical and financial assistance of USSR. Both West Germany and USSR had assisted in the past Indonesia in some of its projects. Iran is building a steel project with economic and technical cooperation with USSR. The first stage would cost about US\$300 million. In Korea, the Ulsan integrated works will be sponsored by a consortium of private investors in the United States, United Kingdom, West Germany and Italy. The cost is about US\$100 million. The Union Steel Manufacturing Company has an expansion programme with the cooperation of Yawata Steel Company of Japan. In Malaysia, the integrated Malayawata steel plant is a joint venture of Malaysian and Japanese investors. Authorized capital is US\$81 million. Participation of International Finance Corporation USA is also anticipated. Australia had assisted in planning a tin plate plant in Malaysia. In Nepal, Indian experts

had assisted in preparing plans for a charcoal blast furnace. It is reported that USSR will be assisting Pakistan in the setting up of an integrated steel works of 1 million tons capacity. In the Philippines, the Export-Import Bank of USA has given a long term credit of US\$62 million for the integrated iron and steel plant. A US consulting firm is assisting in the construction of the plant. In Singapore, the Simalpan Industries Limited imports skelps for pipes and it has 45% foreign capital. There is also a sheet galvanizing plant which imports sheets. In Thailand, there are several tube and pipe plants and galvanizing and tin plate plants working in collaboration with Japanese firms and using imported raw materials.

X. TRADE IN STEEL

140. All the countries in the region except Japan were net importers of steel during the period (1960-1966). India, although a relatively large steel producer, has remained a net importer. Australia was a net exporter from 1962 to 1964 and also in 1966 but was a net importer in 1965.

141. Table IV shows the annual imports of semi-finished and finished steel products in the ECAFE countries from 1960-1965. It may be seen that there was an appreciable increase in imports of about 1.2 million tons from 1960 to 1965, or about 20 per cent during the period.

142. Of the total imports of 5.7 million tons in 1960, the combined share of Japan and Australia was 1.3 million tons or about 23 per cent of the total imports. On the other hand, the combined total of the other ECAFE countries including India was 4.4 million tons or about 87 per cent of the total imports. In 1965, the corresponding combined imports of Japan and Australia were only 10 per cent and of the other ECAFE countries, 90 per cent of the total imports. The trends indicate a steady decrease in the proportion of yearly imports of Australia and Japan and a steady increase in the percentage share of the other countries in the region.

143. The pattern of imported products indicated a steady increase in ordinary steel finished flat products - hot rolled coils strips, skelp, sheets, plates, pipes and sections used in the engineering industries. This is shown in table IV. This trend is likely to continue for the next few years. There will be an increasing demand, however, for semis (ingots and billets) to meet the requirements of new steel works with rolling mill capacities which have not provided complementary steel making facilities in their establishments. A change in the pattern of steel products is likely to take place in the next few years (1970-75) as, by then, new iron and steel complexes, now under construction, will be in operation in the region.

Table IV Pattern of imported finished and semi-finished steel products (1965)

<u>Products</u>	<u>Thousand tons</u>
Ingots and semis	562.8
Railway track material	115.0
Heavy and light sections	153.3
Wire rods	189.8
Strip	209.1
Plates	783.3
Sheets	934.0
Steel tube fittings	667.0
Wire	271.2
Tin plate	632.6
Wheel tyres and axles	85.7

146. The characteristic feature of imports is the predominance of flat products (sheets, plates, tin plates) and sections and tubes. Sheets and plates and and railway material used in the engineering and shipbuilding industries account for about 30 per cent of the total imports.

147. Trade in steel between ECAFE countries as a whole, particularly with the smaller ones, is very small compared with the trade among the developed countries themselves. The flow of trade in steel of both direct and indirect imports is predominantly from the developed countries to the less developed countries.

148. There was a substantial change, however, in the volume of steel trade between the ECAFE countries and Europe and United States in 1965 compared to 1961. The share of the traditional exporters in Western Europe and the United States and other regions was about 3.67 million tons in 1961 or about 71 per cent of the total imports. The balance of 29 per cent was the combined share of Japan and Australia - 25 per cent and 4 per cent respectively. In 1965, the share of Japan's exports increased to 45 per cent and Australia's to 4 per cent, or a total of 49 per cent, whereas the share of the other exporting groups (in the Western world, etc.) decreased to 51 per cent. Japan's steel exports in the international market in 1965 totalled 9 million tons and were valued at \$1,369 million, of which ordinary rolled steel products accounted

Table V Imports of finished and semi-finished steel products
in ECAFE countries 1960, 1963, 1964 and 1965 1/

Ingots, semis, railway track materials, heavy and light sections,
wire rods, scrip, sheets, plates, wheel tyres and axles

(Thousand tons)

Importing group	1960	1963	1964	1965
Total ECAFE region in which	5,679.2	5,194.2	6,149.4	6,922.3
Japan	638.3	36.4	33.6	44.3
Australia	663.5	225.8	473.8	624.6
Selected ECAFE countries of which	3,774.1	4,317.7	5,254.7	5,157.2
Afghanistan	8.6	8.4	9.6	15.5
Burma	76.8	88.4	93.0	96.4
Ceylon	78.0	51.5	90.7	64.1
China (Taiwan)	132.0	165.3	216.4	295.8
Malaysia (Singapore)	104.3	155.8	219.9	248.2
Hong Kong	181.5	390.2	412.9	413.8
India	1,184.9	1,064.7	1,285.1	892.5
Indonesia	240.5	181.1	153.5	253.9
Iran	426.8	370.7	412.5	558.6
Laos		29	14.0	0.5
Pakistan	372.5	588.7	921.2	658.8
Philippines	272.4	390.7	459.2	530.9
Korea, Rep. of	83.6	240.3	117.5	174.2
Viet-Nam, Rep. of	68.8	54.5	68.7	106.9
Thailand	167.8	285.1	305.7	353.3
New Zealand	375.6	289.3	474.8	493.8

for 8.2 million tons or 83 per cent of the total; secondary steel products for 8 per cent; steel ingots and semis for about 5 per cent and ferro alloys about 4 per cent.

1/ Statistics of World Trade in Steel 1965, United Nations.

149. In tonnage, Japan was the world's largest steel exporting country to the ECAFE region. In 1966, exports to the United States by Japan amounted to about 4.7 million tons accounting for 47 per cent of Japan's total direct steel exports;^{1/} exports to Asia and Oceania amounted to about 35 per cent, and the balance went to Europe, South America and Africa. The exports of steel products from the developed countries of the world to the ECAFE region are shown in table VI.

Table VI Exports to ECAFE countries of semi-finished and finished steel products - 1961-1965

(ingots, semis, railway track materials, heavy and light sections, wire rods, strips, sheets plates, steel tubes, fittings, wires, tin plates, wheel tyres and axles - in thousand metric tons)

Exporting Group Origin	1961	%	1962	%	1963	%	1964	%	1965	%
<u>World</u>	<u>4,713.2</u>	<u>100</u>	<u>4,901.8</u>	<u>100</u>	<u>5,194.2</u>	<u>100</u>	<u>6,149.4</u>	<u>100</u>	<u>6,922.2</u>	<u>100</u>
of which										
Japan	1,263.4	24.8	1,533.2	31.3	2,094.0	40.3	2,599.0	42.3	3,164.0	45.7
Australia	209.0	3.9	503.9	10.3	211.4	4.2	305.3	4.9	244.7	3.5
<u>Other countries</u>	<u>3,240.8</u>	<u>69.0</u>	<u>2,864.7</u>	<u>58.4</u>	<u>2,888.8</u>	<u>55.5</u>	<u>3,245.1</u>	<u>52.8</u>	<u>3,513.5</u>	<u>50.8</u>
of which										
USA	616.3	13.6	834.4	17.0	978.8	19.0	1,185.7	19.2	724.0	10.4
UK	926.4	19.7	451.8	9.1	507.5	9.7	713.7	11.7	672.7	9.3
Fed. Rep. of Germany	393.2	8.2	173.3	3.5	186.4	3.5	308.8	5.0	522.7	7.6
Belgium (Lux)	390.0	8.2	208.0	4.0	185.0	3.5	212.0	3.4	312.0	4.5
Others	914.9	19.3	1,197.2	24.4	1,031.1	19.8	824.9	13.4	1,282.1	18.7

Source: Statistics of World Trade in Steel (1962, 1963, 1964 and 1965) United Nations.

150. There has been a steady increase in imports of indirect steel in the ECAFE countries. Imports in 1961 amounted to \$2,860 million, in 1962 to \$3,228 million and in 1964 to \$5,280 million. In 1965, it rose to \$6,030 million. The details are shown in table ^{VII}. The largest importers in 1965 were Australia, India, Japan, Pakistan, Malaysia, the Philippines and Thailand.

^{1/} The Steel industry of Japan 1967, The Japan Iron and Steel Federation.

Table VII Indirect steel imports (1965)

(Million US\$ FOB)

Countries	Products	Total engineering products	Total machinery non-electric	Total electrical machinery	Total transport machinery
<u>Total Asia and the Far East and Oceania</u> ^{1/}		<u>6,029.6</u>	<u>2,844.9</u>	<u>1,206.1</u>	<u>1,789.9</u>
of which					
Afghanistan		49.1	6.4	4.6	8.1
Australia		1,148.3	551.7	201.1	195.5
Burma		47.7	23.1	6.3	17.8
Cambodia		17.8	6.2	3.4	7.8
China (Taiwan)		161.4	70.3	47.8	43.3
Hong Kong		217.4	82.1	92.6	42.8
India		1,113.9	558.1	235.8	219.1
Indonesia		291.3	91.7	42.4	144.0
Iran		294.8	162.5	54.7	77.6
Japan		658.1	416	99.2	142.9
Laos		6.6	2.1	1.1	3.3
Malaysia		291.0	121.7	78.6	90.8
Mongolia		70.2	19.9	5.0	9.0
Pakistan		381.6	201.8	61.8	114.6
Philippines		284.3	131.2	57.3	95.7
Korea, Rep. of		93.0	46.7	23.2	23.2
Viet-Nam, Rep. of		86.0	38.2	22.9	24.9
Thailand		227.3	98.3	40.7	88.3
New Zealand		352.5	134.5	67.4	150.6
Others		169.1	58.8	44.1	65.8

Source: Bulletin of Statistics on World Trade in Engineering Products - United Nations - 1965.

^{1/} Excluding mainland China, North Korea and North Viet-Nam.

XI. CONCLUDING REMARKS

151. (1) In the small producer countries of the ECAFE region, crude steel production increased from 336,000 tons in 1960 to 820,000 tons in 1965 and to 1.0 million tons in 1966, increases of 110 per cent and 197 per cent respectively. Steel consumption rose from 3.8 million tons in 1960 to about 5.5 million tons in 1964, an increase of 47 per cent. The increase in 1965 was about 60 per cent. However, the consumption of steel per capita remained very low at 15 kgs in these countries in 1965. A large gap exists between steel consumption and production in these countries.
152. (2) The small producer ECAFE countries contribute less than one half of 1 per cent to the world steel output and produce only negligible amounts of iron.
153. (3) In the large producer countries (Australia, India and Japan), steel production increased from 29 million tons in 1960 to 53 million tons in 1965, an increase of 80 per cent. Steel consumption rose 50 per cent from 28 million tons in 1960 to 42 million tons in 1965. The average consumption of steel per capita in these countries in 1965 was 71 kgs. In Japan production in 1965 exceeded consumption by about 42 per cent. In India and Australia production rose to 83 and 92 per cent of consumption respectively.
154. (4) Appreciable quantities of raw materials suitable for iron and steel manufacture occur in some of the small producer countries of the ECAFE region, except for coking coal in certain cases.
155. (5) There are small steel plants and rolling mills in about 60 per cent of the small countries in the region. Additional capacity is being installed or is planned in most of them.
156. (6) There are many problems and difficulties to be met and solved before iron and steel production units can operate satisfactorily in some of these ECAFE countries. These problems include the limited size of markets,

the shortages of foreign exchange and trained personnel, transport and power,

157. (7) A realistic approach to the chronic problems hindering the growth of the steel industry in this region would be to study the situation from a regional angle. Efforts might be made to pool resources, capital, and markets and thereby achieve economies of scale. Intra-regional cooperation would improve prospects for the region as a whole.

158. (8) The Asian Conference on Industrialization, at its meeting at Manila in December 1965, envisaged a large iron and steel development programme in the small steel producer and non-steel producer countries of the region for the next 15-20 years. Targets for steel production were set at 4.5 million tons in 1970 and 43 million tons in 1985. It also emphasized the need for regional co-operation for accelerating the development of the steel industry in the region.

159. (9) As an initial step towards the implementation of this programme of steel development in these countries, the Asian Industrial Development Council (AIDC) has commenced its work of investigating the possibilities of harmonizing and co-ordinating the plans for steel development in some of the small steel producer countries in South-east Asia.

160. (10) In consultation with the various Governments concerned, the AIDC is also assisting in examining the feasibility of the establishment of a few integrated iron and steel plants each designed for the mass production of specialized products for sub-regional markets within the area covering Thailand, Malaysia, Indonesia, Singapore, the Philippines and China (Taiwan).





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