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DEVELOPMENTS IN THE IRON AND STEEL INDUSTRY IN THE ECAFE REGION

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SUMMARY

In the last decade, steel consumption in the ECAFE region (excluding Japan and Australia) increased from 16 million to 36 million tons, that is, from 10 kg per capita to a mere 13.7 kg, an unsatisfactory growth rate of 6.5 per cent per year. Production of steel within these countries has been only two-thirds of requirements, requiring massive, continuing imports. Exports have been marginal.

Roughly, these countries have about 10 per cent of the world's total iron-ore resources (against this, they produce 4 per cent of the world's steel and have 55 per cent of the world's population). Coking coals are not plentiful and countries starting an integrated steel industry must rely on imported coal and also large proportions of imported iron ore.

Mini mills of 50,000 - 200,000 tons per year capacity, based on arc furnaces, are being built in many countries. Due to vagaries in prices and availability of steel scrap there has been much interest (and some raw-materials testing) for production of metallized pellets. The unhappy experiences with solid reductant processes and the high prices of gaseous reductants have hitherto been major deterrents in establishing sponge iron plants.

Iran and South Korea have recently joined the ranks of integrated steel producers. The basic oxygen process can be expected to increase its share of total steel production from the present 11 per cent to about 60 per cent in 1980, while open-hearth output would drop from 64 per cent to 17 per cent. The share of electric arc furnace steelmaking could rise to 22 per cent.

Indonesia, Thailand, and Philippines will soon have the requisite level of demand for a 1.0 to 1.5 million ton integrated steelworks, but the major problem in installing new capacity is that of financing. Foreign exchange requirements are high due to the import of practically all equipment and engineering services.

By 1980 steel consumption in the ECAFE region (excluding Japan and Australia) is expected to rise to 90 million tons, an average increase of 9.6 per cent per year. However, indigenous production may barely reach 65 million tons. The addition of about 3 million tons steel capacity per year will itself require concerted efforts by the countries themselves, together with unbiased technical assistance and support from the international steel community, financing agencies, and the United Nations.

Introduction

Expansion of the iron and steel industry has been the subject of continuing discussion and active planning in the developing ECAFE countries during the last decade. There has been a growing appreciation of the need for an assured indigenous supply of steel if economic progress is to be accelerated. Apart from the growth stimuli provided, there is the better utilization of domestic resources and the employment generated in the entire chain of activities set in motion with the installation of a steel plant.

While the need has now been generally recognized, progress in building new steel capacity has been slow. In some instances, the complexity of the technical problems seems to inhibit action; in others, there is the impression that the country should wait a few more years until the market justifies a multi-million ton steelworks as anything smaller is likely to be uneconomic. Both these attitudes are perhaps due to the conflicting advice that governments and entrepreneurs at times receive from various sources.

There are, of course, many real difficulties in expanding steel production in Asia. Apart from the major problem of arranging finance for the steelworks, there is the development of infrastructural facilities; again, many countries now have the requisite level of steel demand but lack the coking coal and iron ore resources needed; trainable manpower is available but the necessary skills and technological inputs have to be arranged.

This UNIDO inter-regional symposium therefore has an important role in setting the problems in their correct perspective, in pointing out the technological options now available, and in giving unbiased information to developing countries.

The ECAFE region includes Japan and Australia, both of which have well developed steel industries. Statistics for the whole region tend to mask the rather unsatisfactory status in the other countries. A distinction therefore needs to be made between the countries which have per capita steel consumptions under 300 kg (referred to as group A in the discussion below) and those with higher consumptions (group B/

/ Consumption

Consumption of steel

The development of apparent steel consumption in the region is shown in Table 1. In the 1960-70 decade, steel consumption in the group A countries increased by 6.0 per cent per year while per capita consumption rose by 6.5 per cent. The 1970 consumption of 19 kg compares quite unfavourably with the world average of about 160 kg per capita. Indeed, apart from Taiwan, Australia, and New Zealand, only Hong Kong and Singapore exceed the world average. Even so, it will be noted that there has been substantial growth in consumption (two fold or over) in China, South Korea, Singapore, Thailand, South Viet-Nam, Iran, and the Philippines.

Table 1: Apparent consumption of crude steel in selected ECAFE countries

	Total (thousand tons)			Per capita (kilogrammes)		
	1960	1965	1970	1960	1965	1970
Group A						
Afghanistan	-	21	13	-	1	1
Burma	100	125	83	5	5	3
China	(9,000)	11,640	22,506	15	17	29
Hong Kong	291	573	647	98	151	198
India	4,643	7,519	6,432	11	16	12
Indonesia	91	320	432	3	3	4
Iran	506	736	1,240	25	30	43
Khmer Republic	-	-	15	-	-	2
Korea, Rep. of	290	400	1,050	8	14	33
Laos	-	1	9	-	1	3
Malaysia	195	367	368	45	66	36
Nepal	7	20	37	-	2	3
Pakistan	438	827	670	5	8	6
Philippines	425	765	1,351	15	24	35
Singapore	-	-	843	-	-	293
Sri Lanka	92	85	94	9	8	8
Thailand	213	425	743	9	15	21
Viet-Nam, Rep. of	98	143	429	7	9	14
Total:	16,538	23,946	36,646	10	14	19
Group B						
Australia	4,070	5,842	6,238	390	517	489
Japan	19,476	28,844	65,882	209	291	676
New Zealand	482	611	918	290	332	396
Total:	24,028	35,314	73,038	232	320	646
TOTAL ECAFE:	40,566	59,260	111,684	61	71	95

Source: UN Statistical Yearbooks and country data.

Progress in Asia is seen in perspective when compared to other developing regions. In the 1960-70 period, Latin America increased its per capita steel consumption from 39 kg to 70 kg and Africa (excluding South Africa) from 10 kg to 12 kg; Asia (excluding Japan) raised its consumption from 10 kg to 19 kg.

Consumption by products shows no consistent pattern in the Asian countries as it is influenced largely by local factors, such as the stage of development of the railway system, whether or not the country is an oil producer, and whether the economy depends on mining or agriculture. In the case of typical countries in the region, the main consumption items are sections and sheets which together account for 50 to 70 per cent of total (Table 2). Use of flat products has increased over the years while that of railway materials and sections shows a decline.

Table 2: Product pattern of steel consumption

		Per capita consumption	Proportion of products in total (%)						
			Railway materials	Sections	Plates	Sheet	Tubes & fittings	Tinplate	Wire rods
Indonesia	(1955)	3	3	29	5	27	17	10	1
	(1962)	3	10	31	7	18	11	2	3
Thailand	(1955)	9	18	31	4	28	6	9	-
	(1962)	11	-	29	5	37	11	4	-
Philippines	(1955)	13	1	15	5	37	8	21	-
	(1962)	20	-	15	8	33	6	12	5
Iran	(1955)	15	30	30	5	11	19	3	2
	(1962)	26	-	44	3	17	26	2	-

Source: World Trade in Steel and Steel Demand in Developing Countries, ECA, 1968

In the group A countries, the share of indigenous production in total consumption has actually declined to under 70 per cent, and substantial tonnages continue to be imported:

	1960	1965	1970
Production, million tons	12.3	18.9	25.1
Consumption, million tons	16.5	23.9	36.7
Production as per cent of consumption	75.0	79.0	68.5

African and Middle East regions depend more heavily on imports; however, Latin America produces a much larger proportion of its needs.

/ In most

In most of the countries, home production meets the requirements of only bar products and, to some extent, of galvanized sheet and tinplate based upon imported rhomas OH strip. Exceptions are India and China which have made strides in production of virtually all categories of products.

Trends in steel production

Table 3 shows the growth of steel production in the ECAFE countries. Of the countries in group A, only five - China, India, Iran, Malaysia, and South Korea - have integrated steel plants starting with iron ore, another nine have semi-integrated plants based on arc furnaces and bar-rolling mills, while the rest have no primary steel production at all. When the whole region is considered, the growth of the steel industry from an output of 38 million tons in 1960 to 125 million tons in 1970 - a rate of 12.7 per cent per year - appears good.

Table 3: Crude steel production in ECAFE region
(in thousand tons)

	1960	1965	1970
Group A			
Burma	-	20	30
China	9,000	12,200	17,294
Hong Kong	-	80	100
India	3,287	6,292	6,227
Indonesia	-	-	10
Korea, Rep. of	50	192	481
Malaysia	-	-	140
Pakistan	12	13	163
Philippines	-	85	290
Singapore	-	70	140
Thailand	-	10	250
Viet-Nam, Rep. of	-	-	30
Total:	12,349	18,962	25,095
Group B			
Australia	3,753	5,400	6,822
Japan	22,138	41,161	93,322
New Zealand	-	88	190
Total:	25,891	46,649	100,344
TOTAL ECAFE:	38,240	65,611	125,439

Source: UN Statistical Yearbooks and country data

The Japanese steel industry's outstanding record is well known. Steel production has expanded from 22 million tons to 93 million tons in the last decade. Japan has demonstrated what is possible even without a raw-material base. Australia has made major strides in development of its ore and coal resources, and has doubled its steel production.

But when Japan, Australia, and New Zealand are removed from these totals of the region, the output has increased at about 7.5 per cent per year, from 12 million tons to only 25 million tons. China and India together account for practically the whole of this tonnage increase, with others showing very little growth.

Actual production has often been much less than rated capacity due to various reasons, for instance, slump in construction in Thailand, anomalies in tariff structure in Philippines, and labour problems in India. This under-utilization of capacity has been a chronic unfortunate feature which puts a great strain on the region's limited resources.

The slow progress towards self-sufficiency in steel is indicated in Table 4. With two exceptions, all group A countries produce less than half of their already low steel requirements, while many had no primary steel production at all. This unsatisfactory position will change by 1980, though not as fast as it should.

Table 4: Proportion of domestic production to apparent consumption in selected ECAFE countries, 1960 and 1970 (consumption = 100)

	1960	1970
Group A		
Burma	-	36
China	100	77
Hong Kong	-	15
India	68	97
Indonesia	-	2
Korea, Rep. of	20	46
Malaysia	-	36
Pakistan	3	23
Philippines	-	17
Singapore	-	22
Thailand	-	34
Viet-Nam, Rep. of	-	11
Group B		
Australia	92	110
Japan	112	134
New Zealand	-	21

The production and share of the ECAFE countries in the world context is shown below:

	1960		1965		1970	
	mill t	% share	mill t	% share	mill t	% share
World	326.4	-	459.00	-	592.00	-
ECAFE countries (group A)	12.35	3.8	18.96	4.1	25.10	4.2
All ECAFE countries	38.24	11.8	65.61	14.3	125.42	21.3

There has been only a small increase in the share of the group A countries although the whole ECAFE region has recorded a gain.

As already noted, steel industry expansion has been hampered by lack of demand, lack of raw materials, and lack of finance. For a country whose gross national product is under five billion dollars, it is extremely difficult to raise say a half billion dollars for a major steelworks even when other conditions may warrant this.

Product and process patterns

While most countries produce bars and rods, facilities for hot rolled flat products are available in China, India, South Korea, and the Philippines. Production of alloy and special steels has made good progress in India, and is being started in Iran, South Korea, and the Philippines.

In these countries, the number of electric arc furnaces is large but their tonnage output is small in proportion to the open-hearth and basic oxygen processes. The present share of various processes is estimated below (excluding China). In 1970, India, South Korea, and Philippines had open-hearths, while India and Malaysia had basic oxygen converters. The large existing open-hearth capacity in India accounts for the high proportionate share of this process. However, by 1980 the picture will change markedly, with electric arc furnace and basic oxygen process both overtaking the open-hearth:

	Percentage share of total steel output	
	1970	1980
Basic oxygen process	11	60
Open-hearth	64	17
Electric arc furnace	19	22
Others	6	1
Total:	100	100

The present status of the iron and steel industry in individual countries is briefly reviewed in Annex I.

Raw materials for iron and steel making

Many countries of Asia have not yet been fully covered by geological mapping and exploration. Recent mineral surveys have indicated good potential reserves, but prospecting work needs to be greatly increased if the countries are to install integrated iron and steel plants based on their own mineral resources.

Roughly, the countries in group A have about 10 per cent of the world's total iron ore resources of about 800 billion tons. (Against this, they produce 4 per cent of world's steel and have 55 per cent of the world's population). The bulk of the high-grade ores are in India, and to some extent in the Philippines, Afghanistan, and Malaysia. Explorations in Thailand, Iran, and Burma have indicated good deposits, although most would need beneficiation while others are in inaccessible areas.

In addition there are large reserves of complex lateritic ores - 2,000 million tons in Philippines and 500 million tons in Indonesia, together with titaniferous magnetitic sands in Philippines and Indonesia.

Taking the area as a whole, the present iron-ore position cannot be considered satisfactory. In the coming years, new integrated steel plants in South Korea and Thailand would have to depend, at least initially, on imported ores. Existing producers such as Malaysia may face difficulties in finding replacements for their depleted reserves. In India, major problems are delays and high costs in implementing mining and agglomeration projects.

With regard to coking coal, the position is similar to that of iron ore - deposits are there but much more prospecting and mines development are needed. China has good reserves, Indian deposits are fair, deposits in Afghanistan and Philippines need considerable development work, while in other countries coking coals are generally not found, although sub-bituminous coals and lignites are available. Under group B Australia has extensive reserves of good quality coals.

/ Availability

Availability of limestone, dolomite, and refractory materials is adequate in the region.

The lack of coking coals in many countries and the economic advantages of electric arc furnace steelmaking plants have resulted in the establishment of a large number of "mini steel mills". However, fluctuations in the availability and price of melting scrap are major problems. Typically, price of imported scrap (mainly from the US and Australia) has been around $ 50 c.i.f., while inland scrap is generally $ 30 to 40 per ton, as high as $ 70 in India. However local scrap generation is limited and countries such as Thailand, Singapore, and Malaysia have already started using increasing proportions of imported scrap. The hope is that with growing production of metallised pellets, the prices of imported scrap would not rise much over present levels.

Technological aspects

While electric furnace steelmaking is advancing rapidly, continuous casting has not yet made much progress in the NCAER countries. There are billet casting plants in India, Iran, Malaysia, Thailand, and South Korea, but, by and large, semi-integrated producers prefer to put their limited funds in expansion of arc furnace and conventional ingot-teeming facilities.

A feature in most countries is the fragmentation of capacity in a large number of small obsolete re-rolling mills, many of which use only rerollable scrap and billet cuttings. They are able to compete, on price, with modern big mills due to low labour wages and low overheads, although product quality is often unsatisfactory. When this fragmentation extends to galvanising, tinplate making, and cold rolling, it aggravates the problems of quality and capacity utilization and also prevents the installation of a modern optimum-sized unit.

Interest in production of pre-reduced ore is high. Countries in the region have conducted pilot tests on their ores but have been reluctant to install plants, due partly to the poor performance of the existing DRI plants in South Korea and Venezuela. Thailand, India, South Korea, and Malaysia are now investigating coal-based pre-reduction-based projects, and it is anticipated that in the next five years there would be over one million tons of metallised pellet capacity in the region.

/ To broadly

To broadly estimate the economics of using pre-reduced materials in electric arc furnaces in this region, three alternative routes can be compared up to the billet stage, namely:

I - Use of metallized pellet (based on solid-reductant process) in arc furnaces with continuous casting

II - Use of metallized pellet (using gaseous reductant) in arc furnaces with continuous casting

III - Use of scrap (no metallized pellet) in arc furnaces with continuous casting

Costs of inputs under present conditions in a typical Asian country can be assumed as follows:

Magnetite fines (60% Fe)	$ 12.00	
Purchased scrap	50.00	
Coal (23% ash)	9.30	(660 kg/t sponge iron)
Naptha, per million kcal	2.20	(4.8 mill kcal/t sponge iron)
Electric power, per kWh	0.05	
Labour, per hour	0.65	

On the above assumptions, preliminary estimates of costs for production of 200,000 t/yr of billets are given in Table 5.

Due to high reductant costs and investments, both pre-reduction routes are approximately $ 10 per ton more expensive than use of 100 per cent scrap, when scrap is purchased at $ 50 per ton. However, use of sponge iron would be more economical than all-scrap when scrap prices rise over $ 65 per ton. Further, this would have the advantages of lower foreign exchange cost and better utilization of indigenous resources.

As the steel industry in most of the ECAFE countries is still in its infancy, there has yet been little adverse impact on environment. When new plants are being planned, there is a temptation to postpone pollution control equipment. Undoubtedly, as steel production expands, close consultation will be needed between industry and government to protect the environment, and at the same time, to permit steel to be produced economically. Arc furnace plants in Kuala Lumpur and Singapore are already being required to install fume-cleaning equipment.

/ Table 5

Table 5: Billet costs by alternative process routes

	I-Sponge iron (solid reductant)	II-Sponge iron (gaseous reductant)	III-All scrap
Scrap : sponge (90% Fe total)	25:75	25:75	100:0
Capital cost, million $			
Concentration, pelletizing and reduction (500 t/day)	14.5	15.5	-
Arc furnaces (2-40 t) and continuous casting	7.0	7.0	7.0
Total:	$ 21.5 mill	$ 22.5 mill	$ 7.0 mill
Manpower, persons	650	650	380
Production costs, $ per ton			
Sponge iron (including concentration & pelletizing)			
Net materials cost	32.11	32.14	-
Cost above	10.76	8.43	-
Works cost of sponge iron:	42.87	40.57	-
Fixed charges (depreciation at 7% and interest at 6%)	10.50	11.20	-
Cost of sponge (incl. fixed charges):	53.37	51.77	-
Billets (including continuous casting)			
Net materials cost	43.94	36.86	59.92
Power & electrodes	12.90	12.90	11.70
Cost above	9.64	9.65	8.38
Works cost of billets:	81.49	79.41	80.01
Fixed charges (depreciation at 7% and interest at 6%)	14.00	14.60	4.55
Cost of billets (incl. fixed charges):	$ 95.49	$ 94.01	$ 84.56

/ labour situation

Labour situation

The experience in most countries is that with well-designed recruitment and training programmes, all categories of manpower for the iron and steel industry in Asia can be readily obtained. Labour costs are still low compared to the industrialized countries, but then so are labour productivities. Recent studies, for instance, have estimated average labour cost, including salaries and all perquisites, in semi-integrated plants as follows:

	US$/month
Singapore	173
Malaysia	120
Korea, Rep. of	130
Thailand	95
Philippines	94
Indonesia	88

Productivity in semi-integrated plants ranges from 350 to 420 ingot tons per man-year, while in fully integrated steelworks it is 70 to 150 tons per man-year. In contrast, ingot ton production per man-year is 250 in Japan. An interesting case is the new Pohang Iron & Steel Co, South Korea, a million ton flat products plant which expects to employ a staff of only about 5,000.

Typical developmental problems

The kind of difficulties and obstacles being faced in the expansion of iron and steelmaking are typified by the examples of three Asian countries - India, with vast markets, fair raw materials, and a well-developed industrial base; South Korea which has a poor materials endowment but is pushing ahead with steel and heavy industries; and Thailand which has a relatively small market, inadequate mineral deposits, but is now planning an integrated steel industry.

India: Iron and steel production has been running at about 60 per cent of capacity. Although Indian ore has satisfactory iron contents, it has an undesirable high alumina-silica ratio. Coals are high in ash and even after washing, produce coke with about 22-25 per cent ash. Consequently, the slag at Indian blast furnaces has high alumina content (up to 27 per cent), and this increases slag viscosity and results in an iron analysis of up to 1.7 per cent silicon. To counteract this, dolomite is used at some plants and slag diluted with quartzite. This in turn causes high slag volumes and low furnace output.

/ There are

There are at present 26 blast furnace in operation - three with working volumes of 600 cu.m, fifteen of 1,000 cu.m, five of 1,700 cu.m, and three of 2,000 cu.m. Hot-blast temperature averages about 800°C. Oil injection has been generally discontinued due to high oil costs. Sinter proportion varies from 20 to 40 per cent.

In steelmaking, open-hearths range in size from 80 tons at Rourkela to 500 tons at Bhilai. Three plants have LD converters - Rourkela (40-60 ton vessels), Visvesvaraya (10-ton vessels for alloy steels), and Bokaro (100-ton vessels in the first stage, 250-ton vessels for expansion). The high-silicon hot metal and poor refractories have caused difficulties in lining life and productivity of the LD converters.

Some 160 electric arc furnaces are operating in India, most of which are under 10-ton capacity, while the largest are the two 50-ton (18,750 kVA) units at the Durgapur alloy steel plant. Electric furnace steelmaking in conjunction with continuous casting at new mini-steel plants is expected to rise from the present 1 million tons to about 2.5 million tons by 1975.

The current problems at Indian steel plants are to increase the productivity of their facilities and reduce production costs. Major efforts are being made, for instance, to improve blast-furnace output from the present level of about 1 ton per cu.m. (as compared to over 2 tons per cu.m in Japan) and reduce the present tap-to-tap times of about 60 minutes at the LD converters. An equally pressing problem is to cut down the cost of constructing new steel capacity in India.

There is no doubt that India has built up considerable capacity to design, manufacture, and construct new steel plants and expand existing ones. With adoption of up-to-date technology and with the relatively lower costs of raw materials and labour which it still enjoys, the industry has a great potential.

South Korea: The Korean steel industry in 1971 (before the Pohang integrated plant started operations) was characterised by a striking imbalance between steelmaking (900,000 t/yr) and rolling mill capacities (2,200,000 t/yr), requiring the import of substantial tonnages of semis. Moreover, as in other developing countries, there was considerable fragmentation of capacity in 17 steelmaking shops (which included a small 70-ton open-hearth, 30 Bessemer converters, and numerous arc furnaces), and 62 rolling mills.

/ The

The $ 15 million SL direct reduction kiln/electric smelter plant at Inchon Steel was intended to pre-reduce magnetite concentrate pellets using high-ash anthracite, and smelt this in a 28,000 kVA reduction furnace to produce liquid iron. But the plant could not be made to operate continuously at rated capacity and was shut down in 1971.

Another problem has been that most of the Korean steel industry's production facilities were quite old - 90 per cent of its steelmaking furnaces and rolling mills had been built before 1960. This high proportion of obsolete equipment which results in high production costs will now change with the commissioning of the 1,000,000 ton Pohang plant (POSCo) and the expansion of various semi-integrated plants.

POSCo will be fully commissioned in 1973, in about three years from date of equipment orders, which is a good performance. The plant which includes one 2,600 t/day blast furnace, two 100 ton LD converters, blooming/slabbing mill, 60 inch semi-continuous strip mill, 132 inch plate mill, and a billet mill, cost $ 310 million, again a reasonable investment. Ironmaking is based almost wholly on imported raw materials.

POSCo is being expanded to 2.6 million tons by 1976, and again to perhaps 5 million tons by 1981. At the same time, a second major integrated plant is being planned. At this pace of expansion, Korea's steel production could exceed 200 kg per capita by 1981, a major achievement for a developing country with practically no raw materials base.

Thailand: Thailand has no integrated plant, although Siam Iron & Steel Co. has three 20-ton charcoal blast furnaces for foundry iron. One of the problems of the Thai steel industry is the under-utilization of bar-rolling mill capacity. There are five semi-integrated plants of which the largest - G S Steel - has a capacity of 120,000 tons per year. In addition, there are six rerollers, giving an aggregate capacity of 600,000 tons, while current bar demand is only half this. There is thus the need to diversify output. Also, as scrap prices are rising, a scrap substitute such as sponge iron is required to be produced.

Three galvanizers, with 12 lines, have a capacity of 200,000 tons per year, and a tinplate plant with hot-dip and electrolytic lines has a capacity of 65,000 tons.

/ Since

Since 1965 studies have been made for an integrated steel plant. Earlier, the low steel demand could not justify optimum equipment and processes, as the consumption has crossed the million-ton mark - and may approach two million tons by 1975 - an integrated plant is now being seriously considered.

It has been a matter of Government policy that the new integrated steel plant should be in the private sector. This causes difficulties in attracting the massive finance required when profitability is likely to be unattractive, particularly if the port, housing, and other support facilities are also to be undertaken by the entrepreneur.

Time-consuming negotiations for suitable financial collaborators have become a feature in the quest of many of the Asian countries for an integrated steel industry. In the case of the Isfahan plant in Iran, the problem was ultimately resolved by sale of natural gas to the Soviet Union, while the Bokaro plant was financed partly through Japan reparations. It is worth noting that in both cases the plants were eventually built without foreign equity participation.

Steel prices

Almost one-thirds of the steel requirements of the group A ECAFE countries are imported, mainly from Japan and partly from Australia, West Germany, UK, USA, and USSR. Economic development in these countries is therefore subjected to some extent to variations in prices and availability of steel on the international market, as well as to difficulties in balance of payments due to an annual recurring cost of over $ 1,000 million for steel imports.

Bars and rods, the main import items, were available from continental sources at f.o.b. prices of about $ 80 in the early sixties, rising up to $ 130 in 1969-70 and dropping to around $ 100 in 1971. When ocean and inland freights, duties, handling costs, etc. are added, selling prices rise substantially, for instance, up to $ 270 per ton in a land-locked country such as Afghanistan.

/ The position

The position is more difficult regarding import of billets, hot-rolled coils, and other semis on which the steel processing plants are largely dependent. When the market was buoyant such materials were practically impossible to secure, causing considerable disruption and under-utilisation of bar re-rolling, galvanising, and tinplate-making capacity. At other times, billets were being exported on the basis of marginal pricing at $ 10 lower than home prices.

Generally, prices of steel from Japan were lower than from other countries, for instance, 20 per cent lower than US imports into the Philippines.

Domestic prices in the ECAFE countries have felt the pressure of rising production costs, as also in the developed countries. In India, for instance, bar prices rose to Rs. 877 per ton (US$ 117) in 1970, an increase of 75 per cent over the 1961-70 decade. Monetary compensation per unit of labour is rising more rapidly than labour productivity. Production costs in India are generally of the same order as in UK or Japan, while they could be lower due to a better materials base and lower labour costs.

In countries with semi-integrated plants and re-rolling mills dependent upon imported billets and scrap, domestic prices were generally high, and were comparable to imported steel due to protective tariffs, freight and handling charges. Domestic bar prices vary from, say, $ 130 per ton in Thailand and Philippines up to $ 170 per ton in Indonesia.

Domestic production costs are rising not only because of the upward trend in skilled labour wages and benefits, but due to high investment costs in plant expansion, low equipment utilization, as well as rising costs of domestic and imported materials and supplies. There is an urgent need for cost reduction.

Trade in steel

During the last decade, the group A ECAFE countries have been net importers of steel. Imports in 1960, 1965, and 1970 are shown in Table 6. In spite of acute foreign exchange difficulties, imports have increased almost three-fold during the decade. Three countries are importing more than a million tons of steel each, and the number of countries importing over 200,000 tons per year has increased from five to twelve.

/ Table 6

Table 6: Imports of steel by ECAFE countries, 1960, 1965 and 1970
(thousand tons)

	1960	1965	1970
Group A			
Afghanistan	8.6	15.5	14.1
Burma	76.8	96.4	47.6
China	-	-	3,027.8
Hong Kong	181.5	413.8	439.1
India	1,184.9	892.5	1,597.1
Indonesia	240.5	253.9	422.4
Iran	426.8	558.6	1,315.4
Korea, Rep. of	83.6	174.2	791.3
Laos	-	0.5	6.2
Malaysia	104.3	248.2	325.8
Pakistan	372.5	658.8	506.0
Philippines	272.4	530.9	579.1
Singapore	-	-	696.2
Sri Lanka	78.0	64.1	95.4
Thailand	167.8	353.3	652.9
Viet-Nam, Rep. of	68.8	106.9	239.4
Group B			
Japan	638.3	44.3	44.3
Australia	663.5	624.6	809.5
New Zealand	375.6	493.8	470.3
TOTAL ECAFE:	4,943.9	5,530.3	12,079.9

Source: Statistics of World Trade in Steel, United Nations

As is well known, steel consumption in the developing countries does not fully reflect the demand as chronic balance of payments difficulties tend to restrict steel imports. This unfulfilled demand forces consumers to turn away from steel to use of concrete for buildings, including factory structures. Moreover, import statistics are not complete and often do not include steel imported as part of turn-key projects and defence requirements.

In some countries stringent protective measures are applied also to safeguard the domestic industry. In other cases, differences in tariffs have tended to encourage import of semi-finished products such as billets while local capacity lies partly idle.

The pattern of imported products (Table 7) shows a pre-ponderance of flat materials, which are currently not produced in most countries.

/ Table 7

Table 7: Imports of steel byproducts in selected ECAFE countries, 1970

	Ingots & Semis	Railway-track materials	Heavy sections	Light sections	Wire rods	Strip	Plates	Sheets	Tubes & fittings	Wire	Tinplate	Wheels tyres & axles	TOTAL
Afghanistan	-	-	-	9.6	1.5	-	-	2.1	0.3	0.5	0.1	-	14.1
Burma	16.8	0.2	0.6	8.5	1.1	1.1	-	4.3	8.1	5.8	1.0	0.1	47.6
China	146.2	49.4	32.0	398.9	167.8	38.8	796.1	691.8	531.7	32.2	130.3	12.6	3,027.8
Hong Kong	35.5	2.5	45.4	144.2	11.9	13.3	55.2	67.7	20.4	17.7	24.9	0.4	439.1
India	210.2	0.8	57.4	92.8	64.0	75.8	468.7	463.1	41.3	16.9	63.8	42.3	1,597.1
Indonesia	0.5	8.7	13.0	66.6	3.0	12.1	22.2	97.4	147.6	36.9	16.0	0.4	422.4
Iran	300.6	3.0	222.0	115.6	22.9	9.7	172.8	301.7	107.2	18.7	41.2	-	1,315.4
Korea, Rep of	473.0	3.5	24.6	11.5	24.0	18.0	61.9	120.4	45.1	2.1	4.2	3.0	791.3
Laos	-	-	-	3.7	-	-	0.1	1.2	0.1	1.0	0.1	-	6.2
Malaysia	5.6	3.6	34.0	35.2	25.8	36.0	48.8	73.9	20.0	9.9	32.1	0.9	325.8
Pakistan	150.4	44.7	15.8	27.6	3.9	17.8	28.5	117.0	61.4	9.4	27.4	2.1	506.0
Philippines	230.0	3.2	18.7	23.8	10.1	11.2	53.9	150.7	28.9	10.1	38.5	-	579.1
Singapore	12.0	5.6	138.3	63.6	24.2	22.2	166.5	84.4	112.1	20.3	46.8	0.2	696.2
Sri Lanka	25.0	4.8	0.5	2.5	8.4	2.8	4.4	25.0	0.9	14.6	5.3	1.2	95.4
Thailand	64.1	27.5	37.1	67.7	33.7	35.5	70.5	222.9	22.2	31.0	40.7	-	652.9
Viet-Nam, Rep of	18.7	-	6.4	42.3	44.2	1.0	4.2	90.7	7.9	1.9	22.1	-	239.4
Others	58.1	1.0	28.0	28.7	7.0	1.1	16.0	17.7	89.6	4.9	5.2	-	263.5
TOTAL:	1,716.9	158.5	665.8	1,136.8	463.5	296.4	1969.8	2,532.0	1,244.8	231.9	499.7	63.2	10,999.3

Source: Statistics of World Trade in Steel, United Nations, 1971.

Steel tubes and fittings are being imported in large tonnages by oil-producing countries such as Iran and Indonesia. Due to the gap between steelmaking and rolling capacities, imports of ingots and semis is also substantial. In South Korea, for instance, slabs, billets, and hot coil accounted for 65 per cent of steel imports, a proportion which will decline with the commissioning of their own integrated plant.

The proportion of various products in total steel imports is shown in Table 8.

Table 8: Product pattern of steel imports in Group A countries, 1967 and 1970 (per cent)

	1967	1970
Ingots and semis	16.20	15.83
Railway track materials	1.81	1.44
Heavy sections	16.54	6.05
Light sections		10.30
Wire rods	4.18	4.14
Strip	4.60	2.70
Plates	9.15	18.00
Sheets	27.00	23.00
Tubes & fittings	6.05	11.30
Wire	4.13	2.12
Tinplate	9.65	4.55
Wheels, tyres & axles	0.69	0.57
Total:	100.00	100.00

Exports from the group A countries have hitherto been sporadic and insignificant. India, for instance, had carefully nurtured a good export market in 1969-70, but has reverted to the status of net importer due to its own rising demands and under-utilization of existing capacity. South Korea has made notable strides and in the next five years is likely to emerge as a major steel exporter.

/ Countries

Countries such as Thailand currently have surplus capacities in bar products and have exported small tonnages. The task of reconstructing the countries in the Indo-China peninsula is expected to give a boost to the export efforts of neighbouring countries. By and large, their own needs continue to be so far in excess of local production that exports can only be marginal. However, in the long-term view, it is logical for Asian countries with a good resource base to process their own raw materials to iron and steel products for export to the developed and developing countries. Such export substitution would not only benefit their economies, but also make for a more rational allocation of skills and a less polluted environment in the industrialized countries.

Outlook on demand and capacity

Table 9 gives estimates of domestic steel demand in selected countries.

Table 9: Estimated steel demand in selected ECAFE countries, 1980
(thousand tons crude steel)

	1980			Growth rate
	Non-flat	Flat	Total	over 1970, % per year
China	28,000	22,000	50,000	8.3
India	10,000	6,000	16,000	9.5
Indonesia	750	750	1,500	13.3
Iran	2,300	2,700	5,000	15.0
Korea, Rep. of	4,700	3,300	8,000	22.5
Malaysia	600	500	1,100	11.0
Philippines	1,100	1,100	2,200	5.0
Singapore	750	700	1,450	8.5
Thailand	1,060	640	1,700	8.7
Rep. of Viet-Nam, Khmer Republic & Laos	330	280	610	7.3
Others	2,400	1,600	4,000	2.8
Total:	51,990	39,570	91,560	9.6

/ Total

Total estimated demand of 91 million tons by 1980 for group A countries represents an average increase of 4.6 per cent per year, compared to an increase of 8.3 per cent over the 1960-70 period. Consumption in Japan can be expected to reach 105 million tons and in Australia-New Zealand 11 million tons. Thus, consumption in the total ECAFE region may well be over 207 million tons by 1980.

Even in 1980, a large number of ECAFE countries will continue to have per capita steel consumptions of under 20 kg (Table 10). In the 1960-80 period, the number of group A countries which consume more than 20 kg will have increased from three to a total of ten.

Table 10: Progress of selected ECAFE countries in per capita crude steel consumption/demand

Per capita consumption range	1960	1970	1980
Over 300 kg	-	-	Singapore
200 - 300	-	Singapore	Hong Kong Korea, Rep. of
100 - 200	-	Hong Kong	Iran
50 - 100	Hong Kong	-	China Malaysia
20 - 50	Iran Malaysia	China Iran Korea, Rep. of Malaysia Philippines Thailand	India Philippines Thailand Viet-Nam, Rep. of
Under 20	Afghanistan Burma China India Indonesia Korea, Rep. of Nepal Pakistan Philippines Sri Lanka Thailand Viet-Nam, Rep. of Others	Afghanistan Burma India Indonesia Khmer Republic Laos Nepal Pakistan Sri Lanka Viet-Nam, Rep. of Others	Afghanistan Burma Indonesia Khmer Republic Laos Nepal Pakistan Sri Lanka Others

/ Domestic

Domestic production capacity will continue to be far short of probable requirements. Due to difficulties in raising capital, organising infrastructural facilities, negotiating technical collaboration, and so on, the gestation period for new integrated steelworks in developing countries is unduly long, often ten years and more. Therefore, unless a project has moved already into the project planning stage, it is not likely to be in operation by 1980. Of course, a large number of semi-integrated plants could fructify much earlier.

Integrated steel projects which have fair chances of materialising in this decade or in the early 1980s are plants of about 2 million tons each at Vishakapatnam and Hospet together with substantial expansions at Bokaro and other existing plants in India (for which $ 5 billion is being allocated in the Fifth Plan, 1974-79); plants of about 1.0 to 1.5 million tons each in Indonesia, Philippines, and Thailand; expansion of Pohang to 5 million tons and a second major steelworks in Korea; expansion of Isfahan also to about 5 million tons and a second major steelworks in Iran; and possibly plants in Pakistan and Singapore. In addition, major new steelworks and expansions of existing plants can be expected in China.

These, together with semi-integrated plants, could double capacity from the 1970-level of 30 million tons to about 65 million tons in 1980, an increase of three to four million tons per year for all developing countries. However, actual production may be significantly lower. This does not take into account exports to countries outside the region. Even so, there would be substantial net imports of 20 to 25 million tons per year by 1980.

Investments required

A total investment of about $ 10 billion would be needed for iron and steel industry expansion in the ECAFE countries in group A in this decade. This in turn will require competent and intensive planning efforts in each country, with substantial technical assistance from international agencies. The costs of mistakes in planning will be high. Further, construction costs in this region have been rising at 3-5 per cent annually and delays in implementation will add substantially to the already heavy investment burden.

/ International

International co-operation

The problems of technology transfer and financial participation must now receive even greater attention. Presently Japan has investments in some 30 iron and steel projects in the region, mainly in Thailand, Philippines, Indonesia, and Malaysia. With the one exception of Malayawata in Malaysia, the investments are all in secondary steel processing ventures, such as galvanising plants, for which the semis are generally supplied from Japan. This pattern will undoubtedly change in the future.

Also, it is now recognised that the cost of a steel project can rise by about 10 to 15 per cent if it is tied to credit from one country, and developing countries would be well advised to place orders on competitive bids from selected suppliers in two or more countries wherever possible.

In principle, considerable economies could be achieved through an integrated planning strategy for steel development on a regional or sub-regional basis; in practice, progress in implementing such multi-national ventures has been insignificant due to the political, tariff, employment, financing and management problems involved. A recent ECAFE study has pointed out the viability of a 250,000 tons per year billet production plant to meet the short-term requirements of the Indonesia-Philippines market, starting as a commercial project in Indonesia. In the five countries of southeast Asia alone (Indonesia, Malaysia, Philippines, Singapore, and Thailand) there is expected to be a shortfall of half million tons of billets by 1975, rising to 1.6 million tons by 1980, after taking into account all proposed expansions.

There are other less complex areas of regional co-operation, such as the recent training of Iranian personnel at India steelworks, research and development on common problems of raw materials utilisation, joint mineral resources prospecting, and so on. A good example is the formation in 1971, at the initiative of ECAFE, of the South East Asia Iron and Steel Institute (SEAISI) at Singapore. Six countries of the sub-region, with Japan and Australia as supporting members, now have a forum for exchange of technical ideas. By its publications and seminars, SEAISI is playing a significant role in the development of the Asian steel industry.

/ Conclusion

Conclusion

The gap between steel demand and indigenous production is widening at an alarming rate in the developing countries of the ECAFE region. Some countries do not have the requisite market, materials, and infrastructure needed for establishing an integrated iron and steel industry and have therefore wisely opted for small semi-integrated plants, supplementing their needs of flat and other special products by imports; other countries now have strong cases for installing two million ton integrated plants but are experiencing difficulties in implementation.

With concerted efforts it should still be possible for this region to add about three million tons of steel capacity per year up to 1980, and even more in the years ahead. This should be considered as a minimum target.

/ Annex

ANNEX

Iron & Steel Production Facilities and
Future Plans of Selected ESCAFE Countries

Existing facilities for iron and steel production together with plans for expansion are briefly outlined below:

Afghanistan

There is at present no iron and steel production facility in Afghanistan. The Government has been studying the utilization of the Haji-Gak iron ore deposit for establishing an integrated steel plant near Bamian, about 45 km from the deposit. The deposit, at an altitude of about 4,000 metres along the watershed of the Baba mountain range, is reported to have a potential reserve of 2,000 million tons, analysing about 60% Fe, 7% silica, 2% alumina and low phosphorous and sulphur. Coals for coking are available in the Sabassak and Laritur fields of the Dargag coal region in the Kabul province of Afghanistan, about 200 km from the proposed steel plant site. Coal reserves are estimated at 80 million tons, including 20 million tons of proved reserves.

The Soviet Union made a preliminary study in 1967 for a plant to produce 140,000 tons of rolled products and 300,000 tons of billets per year. Subsequently, a report has been prepared by a European consortium. The vast natural gas deposit and low level of domestic demand (current imports 15,000 tons/year) would point to the possibility of a sponge iron based operation.

Burma

The only steel plant in Burma in Ywama region (Insein), about 20 km from Rangoon, has been in operation since 1957. Its main facilities include a 12-ton electric arc furnace (capacity 22,000 tons/year), rolling mill (capacity 40,000 tons/year of merchant bars and small slabs), sheet mill (capacity 8,000 tons/year), galvanizing plant and wire products plant. Due to shortage of domestic scrap and difficulties in import of billets, plant production has been low.

Plans for expanding and diversifying the iron and steel industry are being prepared. Potential iron ore reserves are 45 million tons, with proved reserves of 10 million tons. Ores are mainly limonitic with 40 to 60% iron content. Small lignite and coking coal deposits are also available.

Hong Kong

Hong Kong has four leading producers - Fuji Warden Co, Chiap Hua Iron & Steel Works, Shun Wing Co and Shan Fung Iron Works - which have arc furnaces and rolling mills for producing bars. In addition, there are 25 other rerollers who use mainly heavy plate scrap from ship-breaking operations. Total capacity is around 400,000 tons per year of rolled steel products.

Major pipe producers are Hong Kong Tube and Metal Products Ltd which manufactures welded and spiral pipes from ¼" to 60" dia (capacity 30,000 tons/yr), and Hong Kong Steel Pipes Ltd (capacity 6,000 tons/yr).

India

As India is a large producer in the ECAFE region, the pace and manner in which the steel industry has expanded is of interest. India's First Five-Year Plan (1951-56) aimed at increasing capacity of the existing plants - TISCo from 1 million to 1.3 million tons and IISCo from 0.3 to 0.5 million tons. In the Second Plan (1956-61) priority was given to the steel industry, with the object of raising capacity from 1.5 to 6 million ingot tons. Three new plants were taken up, at Rourkela, Bhilai and Durgapur, each with an initial capacity of 1 million tons. At the same time, the TISCo and IISCo plants expanded to 2 million and 1 million tons respectively. The Third Plan set a modest target of raising steel capacity to 10 million tons by 1965-66, by expansion of existing plants and the setting up of a new flat products plant at Bokaro. However, the installation of Bokaro was delayed and existing plants could not be operated at full capacity. Subsequently, there was an acute short of steel which continues during the current Fourth Plan (1969-74).

Apart from the integrated steelworks, there are a dozen major non-integrated producers based on electric furnaces. There are four major alloy steel producers - the Durgapur plant of Hindustan Steel Ltd (capacity 100,000 ingot tons), Mysore Iron Steel Works, Bhadravati (capacity 160,000 ingot tons), Mahindra Ugine near Bombay, and Guest Keen Williams near Calcutta. Total alloy steel capacity at present is about 350,000 tons, which is being further expanded. In addition, there are some 200 re-rolling units which utilize billets or re-rollable scrap to produce bars and rods, flats and light sections.

/ The installed

The installed capacity is shown below:

	Installed capacity 1971-72 million ingot tons
Main producers	
TISCO	2.0
IISCO	1.0
Rourkela	1.8
Bhilai	2.5
Durgapur	1.6
Alloy steel units	
Durgapur Alloy Steel Plant	0.10
Mysore Iron & Steel Works	0.11
Private sector units	0.13
Secondary producers	0.2
Total:	9.44

The Bokaro steelworks (initial capacity 1.7 million tons) started production in 1972, and is currently being expanded to 4 million tons. At the same time, two new steel plants of about 2 million tons each are to be installed at Hazaut and Visakhapatnam and an alloy steel plant of about quarter million tons at Salem.

Potential reserves of high grade iron ore in India are about 30 billion tons. Its hard coal reserves of 125 billion tons are the fourth largest in the world, but coals suitable for coking are only 2 billion tons. Among the developing ECAFE countries, India has a good raw materials base for indigenous steel production as well as for exports.

Indonesia

With the stabilisation of the Indonesian economy, the demand for steel can be expected to rise. Requirements are now around 600,000 tons per year but local production was only 10,000 tons in 1971. Existing steel facilities are:

(i) Ajax Trading Co near Djakarta, which has one 30-ton open hearth and three 8"/10" mills (capacity about 30,000 tons annually);

(ii) Djakarta Iron Products with one 5-t arc furnace;

(iii) Ironsteel works with one 8-t arc furnace and plans for adding another 8-t and two 30-t arc furnaces;

/ (iv)

(iv) Ceasing with plans for installing a 6-t arc furnace;

(v) Tunbak Jaya which operates two galvanizing lines with a capacity of 20,000 tons/year on two-shift basis;

(vi) Inkaria Amathera Co which has a capacity of about 30,000 metres/day of conduit paper and furniture tubes and 1,800 tons/year of nails.

The three projects for iron and steel production planned in the 1960's have not made progress, namely, pig iron plant at Lampung, Sumatra (capacity 35,000 tons/year), steelmaking and rolling mills at Tjilegon, Central Java (capacity 100,000 tons ingot steel), and Kalimantan integrated steel project (capacity 250,000 tons ingot steel).

The Tjilegon project has been taken over by a new company, Krakatau, which plans to complete a rod mill and light section mill and wire drawing plant. A spirally-welded pipe plant has been completed with Dutch and Philippine collaboration. A cold strip rolling mill and a forge shop are being planned with assistance from Japan and Australia respectively. Krakatau has plans to install an integrated plant of about 700,000-ton capacity by 1980.

Iran

In the last decade the economy of Iran has recorded spectacular growth and steel consumption has risen from less than half-million tons in 1960 to 1.3 million tons in 1970. Today Iran has a major iron and steel industry which includes the following:

Arya Mehr steelworks, Isfahan: Work started on this project in collaboration with the Soviet Union. The initial product-mix (900,000 tons/year) envisaged 250,000 tons of structurals, 140,000 tons of bars and rods, 70,000 tons of billets, and 10,000 tons of hoops and light rails. The first blast furnace commenced production in December 1971, followed by the LD-converter, continuous casting shop and rolling mills. Iron ore is supplied from the Chogart deposit, about 550 km from the plant. It is expected that coal will come from the Kerman deposit, 700 km away. Work on the expansion of the Isfahan plant to 4 million tons by 1978 is now in progress.

/ Iranian

Iranian Rolling Mills Co: The Iranian Rolling Mills at Ahwaz has three units. The first was set up in 1967 for producing 65,000 tons/year of rounds and sections, followed by a mill for reinforcing bars (capacity 85,000 tons) and for wire rods (capacity 150,000 tons). An electric arc furnace steelmaking and continuous casting plant with a capacity of about 200,000 tons has also been installed.

Ahwaz Pipe Mill: This plant, installed by NIOC at Ahwaz, consists of a large mill (450-1200 mm tube size, 90,000 tons/year capacity) and a small mill (150-400 mm tube size, 60,000 tons/year capacity). A new mill to produce 12-100 mm diameter pipe with capacity of 50,000 tons per year is being planned.

Ahwaz Pipe and Rolling Mills: IMEDI has installed a plant at Ahwaz (40,000 tons/year capacity) for 25 to 150 mm diameter pipe. A narrow strip/skelp mill with capacity of 200,000 tons/year has also been installed.

Sepanta Industrial & Commercial Co: Sepanta located at Teheran manufactures galvanized sheet (15,000 tons/year) and welded steel tubes (35,000 tons/year).

Studies have been made by UNIDO on plants for production of alloy and special steels in Iran, as well as on ferro-alloy plants. The establishment of a cold rolling mill for manufacture of automobile sheets, starting with imported hot bands, has been under consideration.

Khmer Republic

The only steel rolling mill in the Khmer Republic - Chinh My - has seven stands with a capacity of 20 tons/day for large sections and 5 tons/day for small sections on single-shift basis. It generally rolls scrap steel plate out into 1 m. lengths.

There are a few small steel processing plants, such as:

(i) Hach To - iron castings and machine parts for sugar and rubber industries, picks and shovels, etc.

(ii) Kim Hua Heng - galvanised sheet (capacity: about 8,000 tons/yr, on 12 hours/day working)

/ (iii)

(iii) Svay Rieh - barbed wire and nails (capacity: 3,500 tons/yr nails and 1,500 tons/yr barbed wire, on single shift)

(iv) Sakuroma - nails, barbed wire, wire mesh (capacity: 3,000 tons/yr nails, 200 tons/year barbed wire, 600 tons/yr steel wire mesh, on single shift)

(v) Senly - iron casting (three 600 kg/hr cupolas)

As proposed by the ECAFE/UNIDO steel mission (May 1971), a merchant mill (22,500 tons/yr capacity) is planned for installation at Kampong Som in the Reconstruction and Development Plan (1973-1980).

Korea, Republic of

Demand for rolled steel in Korea has risen from 136,000 tons in 1960 to 1.6 million tons in 1971. However, total indigenous steelmaking capacity was around 900,000 tons, although rolling mill capacity was over 2 million tons. Thus, considerable tonnages of semis and products were imported.

Inchon Iron & Steel Works based on one 70-ton open hearth has a capacity of about 120,000 tons of steel. It is planned to expand this to 300,000 tons in 1973-74 with installations of two 40-ton electric arc furnaces, and to half-million tons by 1976. Inchon's project to produce pre-reduced iron ore in an SL/RN kiln for smelting to liquid iron in an electric reduction furnace has been closed down since 1971 due to technical and economic reasons.

There are 17 plants with steelmaking and 62 with rolling mills, including 42 small section mills, 4 sheet mills and 2 plate mills. Companies such Dongkuk, Kuekkong and Hankuk are expanding their capacities.

The new Pohang Iron & Steel Co in southeast Korea will have a capacity of 1,000,000 tons of steel in 1973. About 80 per cent of the iron ore for the plant and bulk of the coal will be imported. Pohang is to be expanded to 2.6 million tons by 1976 and perhaps 5 million tons by 1981. At the same time there are plans to build a second major integrated steelworks on the southern coast.

/ Malaysia

Malaysia

During Malaysia's First Plan (1966-70) the demand for steel, both sections and flats, has increased substantially and is currently around 575,000 tons. Indigenous production, however, was only 160,000 tons in 1971.

The main producer is the integrated Malaysmata Steel Company at Prai which has a current steel capacity of about 120,000 tons per year. It was founded in 1966, with 51 per cent of capital from Malaysian Government and the balance from Japanese companies. The main facilities include: two 200-ton charcoal blast furnaces (capacity 120,000 tons/year), two 12-ton LD converters and one 10-ton electric arc furnace (capacity 120,000 tons/year), together with ploughing mill, continuous mill, cross-country type finishing mills. A 4-strand Olsson continuous casting machine has been installed for 100 mm SQ billets with capacity of 5,600 tons per month. The expansion of Malaysmata to produce flat products is being studied.

United Malaysian Steel Mill in Kuala Lumpur has one 10-ton arc furnace, an old 6" - 8" rolling mill producing about 8,000 tons per year of flats and rounds, and a new mill with 14" roughing stands and 10" finishing stands. Other producers are Dah Yung, with one 3-ton and one 6-ton arc furnace, Malaysian Steel Works (one 10-ton arc furnace) and Southern (one 6-ton arc furnace).

The capacity of G.I. sheet mills and pipe mills are reported to be as follows:

	Capacity t/yr
Sheet mills	
Federal Iron Works	28,000
Southern Iron & Steel Works	12,000
Malaysia Galvanised Iron Works	24,000
Total:	64,000
Steel pipe mills	
Malaysia Galvanised	36,000
ICC Boon & Sheen Steel Pipes	12,000
Steel Pipe Industries of Malaysia	14,000
Total:	62,000

/ Nepal

Nepal

Presently Nepal has a re-rolling unit at Parwanipur near the India border (capacity about 13,000 tons/yr). Due to difficulties in importing billets, plans are underway to add electric arc furnaces and expand mill capacity to about 30,000 tons. Current imports are around 30,000 tons per year of iron and steel products.

Nepal has been considering the installation of a steel plant since the discovery of the Phulchiokl iron ore deposit 20 years ago. A recent investigation by ECAFE has indicated positive ore resources of 1.6 million tons, with probable and possible resources of another 1.4 million tons. Typical ore analysis is 50% Fe, 11% SiO_2, 3% Al_2O_3, 0.066% S and 0.018% P. Tests on this ore at Natural Metallurgical Laboratory, Jamshedpur had given satisfactory results. Sites near Hitaura in southern Nepal and near Godavri, north of the Phulchoki deposit, have been considered. The use of charcoal blast furnaces or electric smelting furnaces for iron making are possibilities. Major problems are the lack of electric power, charcoal sources, and adequate transport facilities.

Pakistan

There is no integrated steel plant in Pakistan to date. There are about 120 re-rolling mills based on scrap and billets, with an aggregate capacity of about 300,000 tons. Much of the capacity is unutilised. There are a few electric arc furnaces for steelmaking. A plant has also been installed to produce about 20,000 tons/year of alloy steels.

Plans for installation of an integrated steelworks have been under study for some time. A 1,000,000-ton plant has been visualised at Karachi based on imported raw materials, based on credit from USSR.

The Kalabagh steel project is expected to be based on low-grade siliceous ore (30-35% Fe) from the Chichali deposit in northern Pakistan. Potential iron ore reserves are estimated at 400 million tons, with proved reserves of 125 million tons.

Pakistan Industrial Development Corporation has proposed setting up pig iron plants of 80,000 and 30,000 tons per year in Sibi, Baluchistan.

/ Philippines

Philippines

Demand for steel rose steadily from 684,000 tons in 1967 to 996,000 tons in 1969, dropping to 646,000 tons in 1970. Almost 65 per cent of consumption has been in flat products for galvanised roofing sheet and tin plate for canned products.

At present there are nine major semi-integrated steel producers making small ingots from scrap in electric arc furnaces, and 32 rolling mills producing rounds from imported and local billets. Capacity of existing facilities and 1970 production is as follows:

	No. of plant	Capacity t/yr	Production 1970, t/yr
Steel making	9	340,000	107,000
Bar rolling mills	31	1,400,000	282,000
Sheet rolling mills:			
Hot rolling mills	1	300,000	140,000
Cold rolling mills	3	520,000	380,000
Sheet galvanising	8	480,000	133,000
Tinning plants	2	137,000	96,000
Steel pipe & tube mills	7	101,000	30,000

Much of the capacity has been under-utilised due to fluctuations in demand and substantial steel imports.

Currently, Philippines Blooming Mills is the largest steel producer with a capacity of 100,000 tons per year from two 40-ton open hearth furnaces.

Bilmide Iron & Steel Corporation (BISCO) has a cold reversing mill with a capacity of 140,000 tons per year and hot dip and electrolytic tinning lines with capacity of 72,000 tons per year.

Iligan Integrated Steel Mill Inc (IISMI), which took over rolling mill facilities from the National Shipyards and Steel Corp, now has cold tandem mill (400,000 tons/year), electrolytic tinning line (70,000 tons/year), blooming/slabbing mill (1,000,000 tons/year) and steekel mill (300,000 tons/year). Back integration to a capacity of about 350,000 tons has been talked about. The Iligan location has the advantage of port facilities and abundant power from the hydroelectric plant at Maria Christina Falls.

/ The Board

The Board of Investment is considering plans for a major 1.5 million ton integrated iron and steel works to be completed by 1980/81. An integrated plant with capacity of 250,000 tons has also been planned by Santa Ines Steel to be located at Laguna de Bay near Manila.

Marsolo Steel Corporation produces steel ingots in six arc furnaces for rolling to wire rods (capacity 76,000 tons steel per year). Christina Chemical Industries produce some ferro-alloys.

Philippines possesses substantial iron ore deposit - 920 million tons of known reserves. Since 1967 the Philippines Iron Mines Company has been operating a pelletizing plant (880,000 tons/year capacity). Coal reserves have been estimated at 35 million tons, including 10 million tons of coking coals.

Singapore

The demand for steel in Singapore has been growing rapidly with the expansion of ship building and steel transforming industries in the Jurong Industrial Estate. Apparent consumption rose to 760,000 tons in 1971, of which local production was 146,000 tons.

National Iron & Steel Mills, the largest producer, has two 20-ton and one 40-ton arc furnaces, and three bar mills (capacity 120,000 tons/year) of high tensile deformed bars, flats and light angles. A rolling mill under construction would raise capacity to 265,000 tons. With addition of a second 40-ton arc furnace, steelmaking capacity is to be raised to 270,000 tons.

Other steel facilities include two re-rollers and the following:

(i) Simalman Steel Industries Ltd producing electrically welded pipe, ⅜" - 4" dia, capacity 1,800 tons/month; Spirally welded pipe, 6" - 48" diameter; pipe galvanizing, lining and related facilities.

(ii) Malaysia Steel Pipe Manufacturing Co - two lines for electrically welded pipe (½" - 6" dia), capacity 10,000 tons/year, of which 6,000 tons is galvanised.

/ (iii)

(iii) Singapore Galvanizing Industries Ltd - produces hot dip galvanized sheet, 2.5 - 3.0 feet wide and 6 - 10 feet long, capacity 12,000 tons/year.

(iv) Eastern Wire Manufacturing Co - produces 750 tons per month of drawn wire & nail wire, and 750 tons per month of galvanized wire.

Sri Lanka

Ceylon Steel Corporation started production at its Oruwela rolling mills in March 1967. The original plant had a capacity of about 60,000 tons/year of rolled products on a two-shift basis, starting with imported billets. The plant facilities consist of billet re-heating furnace (28 tons/hour), roughing mill (one 3-high 500 mm stand, two 2-high 400 mm stands), finishing mill for merchant bars and sections (three 2-high 400 mm, one 2-high 350 mm, two 2-high 250 mm), wire rod mill (six 2-high 250 mm), wire drawing and wire products shop.

A study in 1969 on expansion of the Oruwela plant proposed one 30-ton electric arc furnace and 3-strand continuous casting machine to produce 45,000 tons of billets/year. Subsequently, it is planned to produce 65,000 tons of billets, rising to 108,000 tons.

In addition to the state-owned Ceylon Steel Corporation, there are two privately owned plants for galvanised sheets, with capacities of 12,000 tons per year and 10,000 tons per year.

Sri Lanka has iron ore reserves of about 30 million tons, of which the largest are at Kurunegala (7 million) and Panirendawa (5 million). Coking coal is non-existent.

Thailand

During the decade 1960-70, industrial development in Thailand has been rapid, with real GDP expanding at an average rate of about 8 per cent. The Third Five-Year Plan, which began in October 1971, visualises an expenditure of 100 billion baht (US$ 5 million).

/ Pig iron

Pig iron production started in 1959 and a re-rolling mill was commissioned in 1962. Steel production capacity was built up rapidly in the middle-60s. However, there is to-date no integrated steelworks in Thailand. The bulk of the production is in bars and rods. Most of this capacity is in non-integrated plants with arc furnace and ingot casting facilities. In addition, there are steel pipe, galvanizing and tinning facilities.

Steel demand in 1971 was about 900,000 tons, of which only one-third was produced indigenously. Briefly, production facilities are reported to be as follows:

	No. of plants	Capacity, t/yr
Steel bars	11	550,000
Galvanised sheet	3	215,000
Steel nails	17	96,000
Galvanised wire	4	80,000
Galvanised pipe	4	133,000
Tinplate	1	27,000

The above capacities are currently in excess of local demand in many categories.

Siam Iron and Steel Company, located at Ta-Luang, Saraburi, about 120 km from Bangkok, utilizes iron ore from Khao Thap Kwai, Lopburi, for iron-making in charcoal blast furnaces. The iron produced is used for making grey and malleable iron castings. The major facilities include: three 20-ton charcoal blast furnaces, three high frequency furnaces (100 kg, 500 kg and 2,000 kg), three 8-ton high frequency furnaces, one 5-ton 300 kVA arc furnaces, two 30-ton 10,000 kVA arc furnaces, one 3-strand machine (100 x 100 mm billets), one merchant mill (150,000 tons per year of rods and light sections), one pre-stressed concrete wire plant. SISCO also has foundries, grey iron, 4,500 tons per year, malleable iron 2,000 tons per year, steel 3,500 tons per year.

It is planned to install two 320-ton per day charcoal plant furnaces, LD converters, and additional continuous casting plants, together with expansion of the existing rolling mill to about 230,000 tons per year capacity. Production in 1971 was about 20,000 tons of iron and 60,000 tons of steel products. Capacity in 1972 is about 120,000 tons of steel products.

/ U.S. Steel

G.S. Steel Co., Ltd. (a joint Thai-Japanese venture) near Bangkok, started production in 1967. It now has three 20-ton electric arc furnaces (normally charged to 25 tons, 7,500 kVA transformers) producing an average of about 8 heats per day. This plant has a rolling mill to produce round bars (6-25 mm diameter) at a rate of about 25 tons per hour. In 1970 GS Steel produced about 111,000 tons of ingots, rolled to about 105,000 tons of finished products. Production dropped about 5 per cent in 1971, but is expected to rise again to about 115,000 tons of products in 1972.

Thai-India Steel Co (also a joint venture of Thai and Indian) has a semi-integrated plant comprising a 5-ton arc furnace and a small open-type rolling mill of about 10,000 tons per year capacity which was closed down in March 1972 when their new mill with 50,000 tons per year capacity went into production. Considering the present duty (20 per cent) on imported billets, the company is now envisaging installing a 20-ton arc furnace with continuous casting in order to remain competitive.

There are a few small scrap steel melting and rolling units such as Bangkok Steel Co, Round Steel Co, Universal Steel Work, Bangkok Steel Producing Co, etc. which produce a few thousand tons each of steel bars (6-25 mm) annually.

The Government is considering the installation of an integrated iron and steel work with an initial capacity of about 1,000,000 tons per year. This may start with a cold rolling mill with back-integration to steelmaking and ironmaking facilities. As the known iron ore deposits in Thailand are not of adequate quality or quantity, the integrated steelworks may need to start operation with high proportion of imported iron ore as well as coal.

Laos

The current Five-Year Plan (1969-74) lays stress on infrastructural developments such as the Nam Ngum Dam. The emergency situation deters investment in industrial development, at the same time, there is a serious lack of managerial and technical manpower.

/ There is

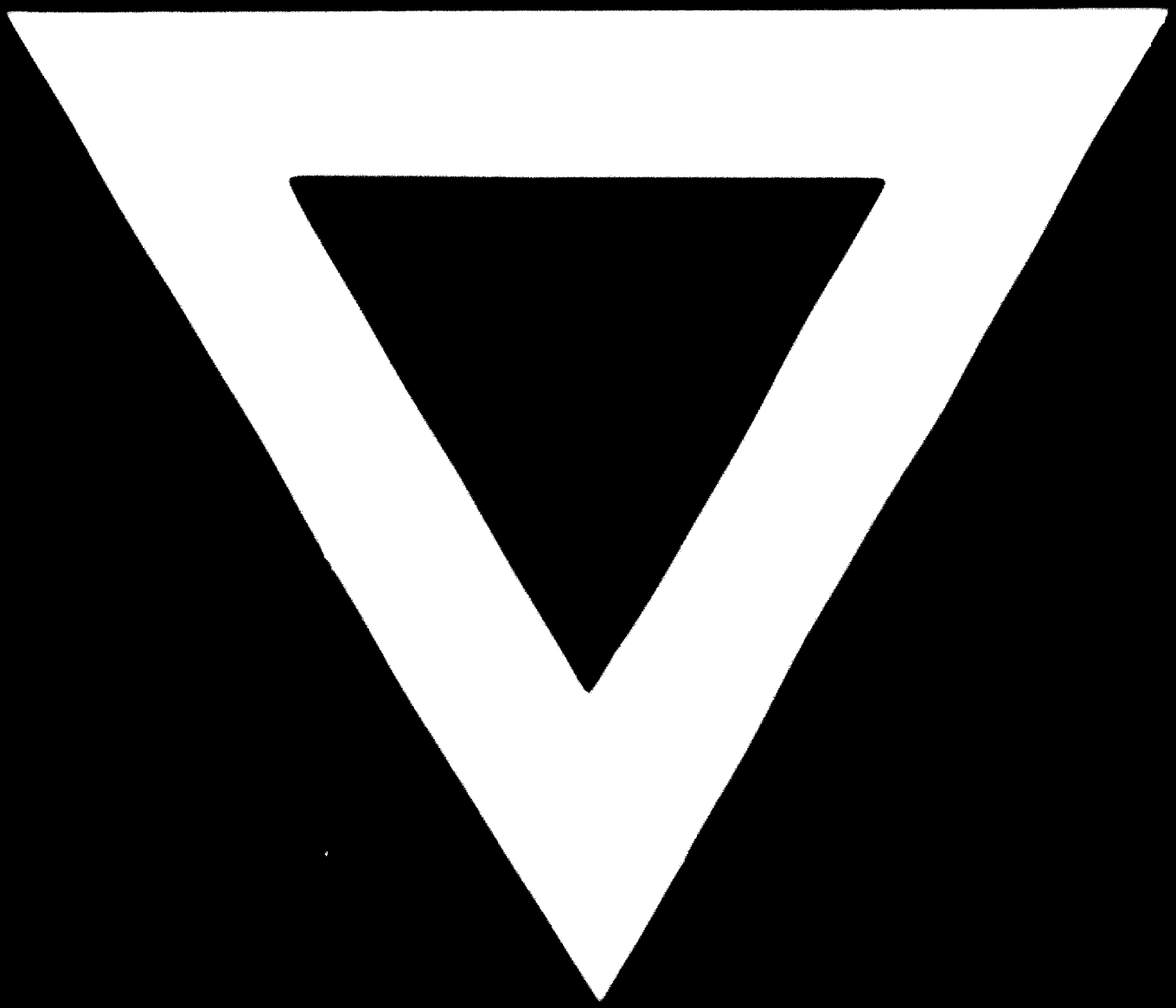
There is no local iron and steel production in Laos. Imports of bars and rods have been around US$ 3 million annually. A wire drawing and nail plant consumes about 325 tons per year and other small shop for window frames, etc. consume about 200 tons per year.

The ECAFE/UNIDO steel mission in May 1971 suggested the future installation of a small iron foundry (1,200 tons/year capacity) and rolling mill (about 8,000 tons/year capacity).

Viet-Nam, Republic of

There has been considerable industrial activity in Viet-Nam despite the disruption caused by war conditions. Two plants based on arc furnace steelmaking, located at Bien Hoa industrial estate, 30 km from Saigon, are VICASA (two 6-ton arc furnaces and rolling mill, capacity 25,000 tons/year) and SADAKIM (one 1-ton arc furnace and rolling mill, capacity 6,000 tons/year).

In addition, the Dan-a and Vithaco plants have 6-ton arc furnaces each and roll about 12,000 tons/year of reinforcing rods. Rerolling mills include VIKIMCO, VIET THANI and MY CHAU, with total capacity of about 25,000 tons per year. There are about 20 small foundries (capacity 8,000 tons/year), four galvanizing plants (capacity 80,000 tons/year), one pipe and tube manufacturer (capacity 2,000 tons/year) and five wire drawing plants.



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