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UNIDO/ESCAP Project on
Industrial Progress of Selected Sectors in
the Developing ESCAP Region

Volume II

PRELIMINARY ANALYSIS OF THE IRON AND STEEL INDUSTRY IN THE DEVELOPING ESCAP REGION

Sectoral Working Paper Series
No. 45

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Sectoral Studies Branch
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SECTORAL WORKING PAPERS

In the course of the work on major sectoral studies carried out by the UNIDO Division for Industrial Studies, several working papers are produced by the secretariat and by outside experts. Selected papers that are believed to be of interest to a wider audience are presented in the Sectoral Working Papers series. These papers are more exploratory and tentative than the sectoral studies. They are therefore subject to revision and modification before being incorporated into the sectoral studie..

This paper has been elaborated in co-operation with Dr. G. Mukherjee as UNIDO consultant. Views expressed are those of the consultant and do not necessarily reflect the views of the UNIDO secretariat.

Preface

UNIDO's Division for Industrial Studies and the ECAP/UNIDO Division of Industry, Human Settlements and Technology have jointly carried out a project on "Review and appraisal of industrial progress at the regional level". This project has been executed in two phases. Phase I of the project consisted primarily of the analysis of statistical data and based on the findings and recommendations a summary was prepared under the title "Industrialization trends in developing ESCAP countries" (E/ESCAP/IHT.6/10). Phase II of the project included the preparation of several sectoral studies, specially in those sectors more relevant for the region. The selected sectors were as follows: capital goods industries, iron and steel, petrochemical and chemical industries and wood and wood products.

The studies prepared by consultants to UNIDO and ESCAP were submitted for discussion in the Workshop on Accelerated Growth Through Co-operation in Selected Industrial Sectors in the Developing Countries of the ESCAP Region which was convened at Bangkok from 1 to 5 July 1985. This sectoral working paper is based on the consultant's report as well as on the discussions at the Workshop and on updating by the UNIDO secretariat.

Other sectoral working papers will be issued covering the other industrial sectors under analysis in the project.

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1. INTRODUCTION

The thirty-nine ESCAP countries in Asia and the Pacific have 2,300 million people accounting for about 55 per cent of the total world population. Around 800 million people in these countries live below the poverty line constituting the largest poverty concentration in the world. These countries differ considerably in terms of geographical position, area, population, resource endowment, economic size and socio-economic and political environment. In the developing ESCAP region, agriculture continues to be the largest source of employment and is the most important contributor to GNP. However, a definite process of growth accompanied by a structural shift from agriculture to industry is clearly discernible. Practically all the countries of the developing ESCAP region find themselves in various phases of this structural shift from agriculture to industry.

Despite competition from other materials for many uses, the steel industry continues to be regarded as the most important single parameter for industrialization by most governments of the developing countries. Steel output was considered to be an important indicator of national economic strength for almost a century before national income accounting became common. The steel industry is essentially a resource based industry requiring iron ore, coking coal, limestone and power. Before the Second World War the location of iron making was largely determined by the availability of coking coal and iron ore.

The steel industry is generally considered as the key of the national economy of any country. As the country moves forward, diversification of steel products to meet the country's various requirements becomes an obvious conclusion. Moreover, the steel industry is another industry that creates a number of subsidiary industries both up-stream and down-stream and produces a cumulative and multiple spin-off effect in terms of employment, infrastructural development, technology and other related items.

During the mid 1960s, the developing countries produced only around 4 per cent of the world steel and consumed just over 7 per cent. During the period 1960-1980, the steel production of the world as a whole has more than doubled. Production in the developing countries has grown by nearly seven times its initial level. But in 1981, it still accounted for less than 10 per cent of the world total.

The industrialized countries had a rapid expansion during the 1960s when the rate of growth was around 6 per cent per annum, thus being replaced by stagnation or even decline during the 1970s. Over the same period, the developing countries have collectively increased their level of steel use to nearly five times the initial level thereby doubling their share of world consumption.

It is important to note that during the 1970s, the developing countries as a group had not only managed to maintain their rate of growth in steel use but also were able to increase it during the period when consumption in industrialized countries was shrinking.

The developing countries of Asia and the Far East are forecast to continue the expansion of their steel use. It is a well-known fact that there is no example of sustained economic and industrial growth in a country without domestic steel production and there are a number of very real incentives and compelling reasons for establishing a national steel industry, such as

(a) To make use of domestic natural resources;

(b) To replace imported steel by domestic products and save on foreign exchange;

(c) To accelerate the growth of steel consuming industries and sectors;

(d) To promote ancillary industries and sectors;

(e) To create employment.

However, the road to industrialization via the steel industry is not free of problems and furthermore steel making is among the more expensive ways to industrialize. Also in general, investment expenditure not only for steel

plants but also for other industrial operations tends to be higher in developing countries than in industrialized countries. The main reason is that in most cases a parallel infrastructure has to be created.

While the question of large investment expenditure is among the crucial problems which arise when a national industry is established, there are many related planning needs which need careful consideration before the irreversible decision is taken to start the domestic steel production.

The major objective of this sectoral study on the iron and steel industry in the developing ESCAP region is to provide a brief review and analysis of past developments, the present situation, basic problems and future trends and prospects of development of the iron and steel industry. Amongst the developing countries of the ESCAP region, the steel situation is comparatively poor both from the point of view of per capita consumption and self-sufficiency. The geographical distribution of steel production and consumption in the years 1974 and 1983 is given in table 1. Based on the growth level projections for steel demand, the per capita consumption is expected to increase substantially in these countries by the turn of the century. In fact, the study examines the various aspects of setting up a steel industry in the developing ESCAP countries. The study covers the following countries:

Afghanistan, Bangladesh, Burma, area of Hong-Kong, India, Indonesia, Iran, the Republic of Korea, Malaysia, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka and Thailand.

While the economy of these developing ESCAP countries is generally agro-based and labour intensive, a few of these developing nations are favourably placed for a potential development of the iron and steel industry on account of the following considerations:

Table 1. Geographical distribution of steel production and consumption in 1974 and 1983

	1974 (per cent)		1983 (per cent)	
World total : 704 million metric tons		World total: 662 million metric tons		
Production:				
Industrialized countries	65.8		51.6	
Developing countries	4.4		9.6	
- Latin America		2.5		4.4
- Africa, except South Africa and Middle East		0.3		0.7
- Asia except Japan, China, DPR Korea		1.7		4.5
Centrally planned economies	29.8		38.8	
Consumption:				
Industrialized countries	59.2		45.5	
Developing countries	9.9		14.4	
- Latin America		4.4		3.5
- Africa, except South Africa and Middle East		2.5		4.4
- Asia except Japan, China, DPR Korea		3.0		6.5
Centrally planned economies	30.9		40.1	

Source: World Steel in Figures 1984, IISI Publication.

(a) Ecological;

(b) Human resources;

(c) Raw materials;

(d) Growing market;

(e) Suitable sites.

Since the ESCAP member countries include both the developing and developed countries, there exists a strong possibility of an interaction between them in terms of technology transfer, financial assistance and raw materials and product linkage.

In order to ensure sustained growth in the economy of both developing and developed ESCAP region countries, the need for setting up basic industries like steel is obvious. Installation of steel plants shall help in the exploitation of domestic resources and shall create employment for people directly as well as indirectly in the various down-stream industries.

2. REVIEW OF THE PAST ECONOMIC DEVELOPMENTS AND THE PRESENT SITUATION

The recession that has afflicted the world economy since 1980 seems to be easing gradually. But the economic conditions of many developing countries have, however, further worsened. Many middle-income countries have today faced a greater liquidity crisis than was expected. This was brought on by high interest rates and reduced demand for export. Low-income countries, dependent on the export of raw materials, have suffered historically from low commodity prices in real terms.

The developing countries' present difficulties are the culmination of events dating back a decade or more. Table 2 gives the detail of key indicators for industrial as well as developing countries.

These dificulties are a consequence partly of conditions in the industrial market economies and partly of their own policies.

2.1 The 1980-82 recession

The recession during the period was no simple repetition of the mid 1970s recession. Following the increase in oil prices in 1973, GDP growth rates in the industrial economies fell sharply for two years and then recovered rapidly in 1976, although in the three subsequent years growth was still well below the average for the 1960s. In contrast growth rates were initially less depressed by the 1979 rise in oil prices, but subsequently failed to match the recovery seen after 1975. The second recession was shallower than the first, but it has lasted longer since industrialized countries tightened monetary controls to bring down inflation. As a result, unemployment in the industrial countries which stayed high at about 5 per cent after the first recession, has since climbed to more than 8 per cent.

Developing countries are directly affected by fluctuations in the industrial world (figure 1). Their overall growth rates have been higher, but even those that have grown fastest have not been able to avoid the cyclical influence of industrial countries. They have also been affected by high

interest rates. Both effects were powerful in the early 1980s when many developing countries have been squeezed between stagnating foreign exchange earnings and soaring interest payments on their debt.

Table 2. Key indicators, 1973-1982 (Percentage)

Indicator	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982 a/
World trade growth (volume) b/	12.5	4.0	-4.0	11.5	4.5	5.0	6.5	1.5	0.0	-2.0
Industrialized countries										
- GDP growth	6.3	0.6	-0.7	5.1	3.6	3.9	3.2	1.3	1.0	-2.0
- Unemployment	3.4	3.7	5.5	5.5	5.4	5.1	5.0	5.6	6.5	8.0
- Inflation rate	7.7	11.6	10.2	7.3	7.4	7.3	7.3	8.8	8.6	7.5
Developing countries										
Oil importers										
GDP growth	6.5	5.3	4.0	5.3	5.6	6.6	4.2	5.0	2.2	2.0
Debt service ratio c/	12.6	11.4	13.3	12.6	12.7	15.7	14.7	13.9	16.6	21.5
Oil exporters d/										
GDP growth	9.1	7.2	3.7	8.2	4.8	2.4	1.2	-1.3	1.5	1.9
Debt service ratio	12.2	6.7	7.8	8.4	11.1	14.9	15.5	13.0	15.7	19.1

a/ Estimated.

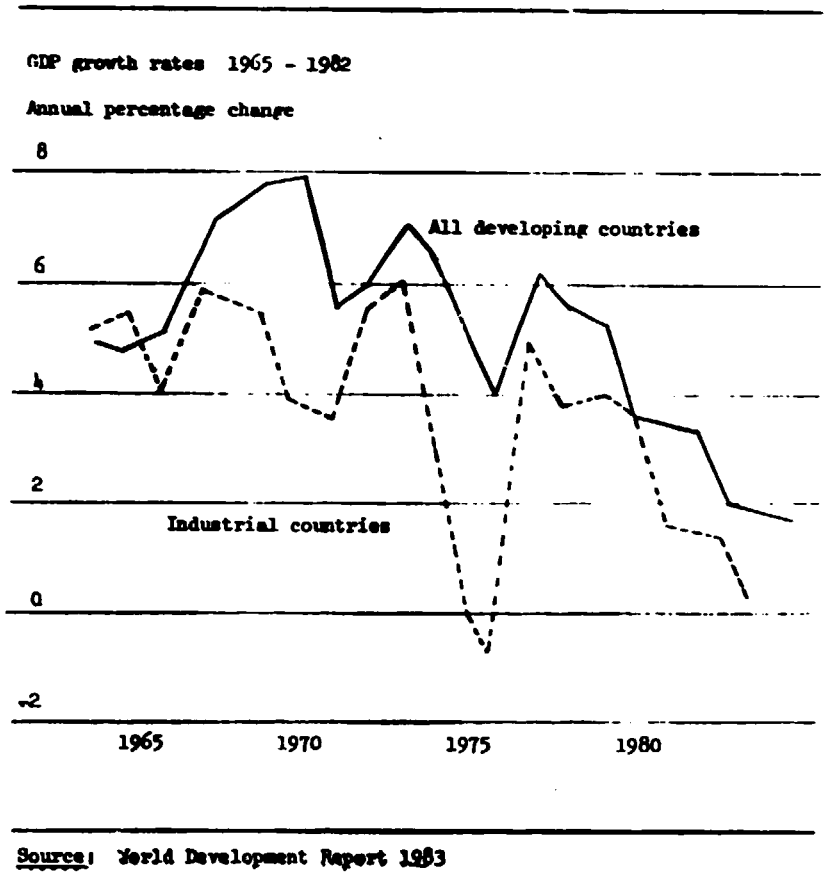
b/ IMF data for 1973 to 1981; GATT data for 1982.

c/ Service on medium and long term debt as a percentage of exports of goods and services.

d/ Excludes the People's Republic of China.

Source: World Development Report 1983.

Figure 1.



Source: World Development Report 1983

Developing countries have reacted to these pressures in different ways. Those middle income countries that had adopted outward oriented trade policies - mainly in East Asia - have managed to maintain the momentum of export expansion and avoid serious new debt problems.

The two largest low-income countries - the People's Republic of China and India - have come through the current recession with encouraging resilience. They were not so heavily dependent on foreign trade, had little commercial debt, and so were not much affected by high interest rates. They have also made impressive progress in agriculture.

The state of economy will determine whether a country is ready for economic development. A prerequisite is that the GDP per capita has reached a level signifying that the economy is moving from a stage of underdevelopment towards the start of industrialization. The exact level of per capita income corresponding to a change-over will vary with the type of economy and may be between US$ 400 and US$ 800.

The per capita GDP in the developing and a few developed ESCAP countries is presented in table 3. It may be observed that the per capita GDP of developing ESCAP countries is generally low except for Fiji, the area of Hong Kong, Iran, the Republic of Korea, Malaysia and Singapore where the per capita GDP is above US$ 500 in the year 1980 at 1975 prices.

Table 4 gives the sectoral structure of GDP at constant (1975) market prices for the selected ESCAP countries. An analysis of the sectoral contribution to the GDP in the developing ESCAP region countries indicates that the major contribution to the GDP is from agriculture which generally ranges from 30 to 60 per cent. The contribution from the manufacturing sector is comparatively low at present and is about 10 to 30 per cent. Contrary to this in the developed countries the manufacturing sector has much higher contributions of about 30 to 50 per cent and the agricultural sector contributes only to the extent of 5 to 10 per cent.

The International Development Strategy for the Third United Nations Development Decade constitutes the basic guidelines whereby the international community has agreed to intensify co-operative efforts to accelerate development in the developing countries and eliminate the inequities of the existing international economic order.

In this global context of the ESCAP region's input into the formulation of a strategy together with a regional action programme elaborated in the light of the goals, the strategy should specify a series of quantitative targets which must be met if the existing disparities between the developing and the developed countries are to be reduced.

The Commission recognized in its Thirty-seventh Session that in order to meet the regional development objectives for the Third Development Decade, the developing ESCAP countries would have to achieve as a minimum the following targets: an acceleration of the annual growth of GDP from 6.4 per cent in the 1970s to 6.7 per cent in the 1980s; an increase of agricultural output from 2.7 to 6.5 per cent and of industrial growth from 8.7 to 8.9 per cent; an increase in the investment - GDP ratio from 19.7 to around 22.2 per cent; and

Table 3. Per capita GDP of selected ESCAP countries in 1975 US$

Country	1960	1970	1980
Developing countries			
Afghanistan	92	85	103
Bangladesh	...	126	142
Burma	69	97	116
Fiji	813	858	1,191
Area of Hong Kong	682	1,476	2,746
India	122	123	143
Indonesia	154	168	289
Iran	550	1,157	1,102
Republic of Korea	236	405	778
Malaysia	426	636	1,062
Nepal	117	121	121
Pakistan	...	163	194
Philippines	251	324	446
Singapore	909	1,732	3,561
Sri Lanka	212	267	357
Thailand	182	280	452
Industrialized countries			
Australia	4,198	5,947	6,886
Japan	1,572	3,843	5,453
New Zealand	3,229	3,937	4,569

Source: UNIDO
UN Monthly Bulletin of Statistics, various issues.

Table 4. Sectoral structure of GDP at constant 1975 market prices in selected ESCAP countries (1960, 1970 and 1978) (Percentage)

	Year	Agriculture	Industry	Services
Developing countries or areas				
Afghanistan	1960	75.6	14.1	10.3
	1970	61.0	24.7	14.3
	1978	55.1	28.1	16.8
Bangladesh	1960	62.4	8.1	29.5
	1970	58.2	11.2	30.6
	1978	50.3	15.2	34.5
Burma	1960	37.5	9.8	52.7
	1970	42.9	10.3	46.9
	1978	45.5	11.2	43.3
Fiji	1960	38.7	31.3	30.0
	1970	31.8	30.4	37.8
	1978	26.7	25.9	47.4
Area of Hong Kong	1960	11.2	30.3	58.5
	1970	4.4	36.4	59.2
	1978	0.8	33.1	66.1
India	1960	51.0	19.4	29.5
	1970	44.4	23.4	32.3
	1978	39.6	25.5	34.9
Indonesia	1960	46.4	22.8	30.8
	1970	39.1	28.0	32.9
	1978	29.2	35.5	35.2
Iran	1960	22.3	52.3	25.4
	1970	12.1	64.5	23.3
	1978	10.0	53.8	36.2
Republic of Korea	1960	45.4	13.8	41.7
	1970	31.2	26.4	42.4
	1978	19.4	41.4	39.2
Malaysia	1960	30.4	25.5	44.1
	1970	30.7	31.4	37.9
	1978	26.1	33.3	40.6
Nepal[a/]	1965	68.0	10.0	22.0
	1970	70.0	11.1	18.8
	1978	61.7	12.3	26.0

Table 4 (continued)

	Year	Agriculture	Industry	Services
Pakistan	1960	40.8	18.7	40.4
	1970	35.2	24.5	40.3
	1978	29.8	24.5	45.7
Papua New Guinea[a/]	1960	48.9	13.5	37.7
	1970	36.0	25.5	38.5
	1978	37.3	24.7	38.0
Philippines	1960	33.6	27.6	38.8
	1970	31.1	29.9	39.9
	1978	28.2	35.1	36.7
Singapore	1960	4.8	21.8	73.5
	1970	2.8	33.7	63.5
	1978	1.6	34.0	64.4
Sri Lanka	1960	46.0	16.1	37.9
	1970	41.8	19.3	38.9
	1978	36.6	22.2	41.2
Thailand	1960	41.6	17.8	40.6
	1970	33.5	23.3	43.2
	1978	28.2	29.9	41.9
Centrally planned economies				
Mongolia	1960	22.9	21.3	55.8
	1970	25.3	28.4	46.3
	1978	20.0	31.4	48.6
Industrialized countries				
Australia	1960	7.5	38.1	54.4
	1970	5.8	38.7	55.5
	1978	5.7	34.7	59.6
Japan	1960	14.7	38.7	46.6
	1970	6.1	41.6	52.3
	1978	4.5	43.4	52.3
New Zealand	1960	14.9	25.2	59.9
	1970	12.4	29.1	58.5
	1978	10.2	30.3	59.5

a/ GDP at current market prices.

Source: UNIDO Bulletins.

a substantial increase in the foreign resource inflows. A minimum rate of growth of 8 per cent per annum for industrial export was also recognized to be essential to the attainment of the target set in the Lima Declaration and Plan of Action.

In view of the heterogeneity of the ESCAP region, the regional targets were further refined to allow for different economic and social conditions prevailing in the main sub-regions of Asia and the Pacific. Thus a higher target rate of GDP growth was set up for East and South-East Asia, 7.5 and 5.7 per cent respectively, while a lower rate of growth of agriculture was envisaged for East and South-East Asia (3 per cent) than for South-Asia (3.6 per cent). For industrial production, the minimum target growth rates were set at 8.2 per cent for South Asia and 9.9 per cent for East and South-East Asia.

Table 5 gives the average annual rates of growth of production by sectors. It may be observed that the average annual growth rates in agricultural production has generally shown a declining tendency during 1970 to 1978 as compared to the period 1960 to 1970. The growth rates in the production of industry and services sectors, however, have not registered a substantial increase.

Table 6 gives the value for percentage change in the real GDP for the selected developing ESCAP countries. As can be seen, the growth rates in several developing ESCAP countries remained well above the level of regional strategy goals in 1980 and 1981. Against this, the performance in 1982 showed a drastic deterioration of the economic conditions in the region. Although more than half the economies of the region still achieved growth rates between 4 and 6 per cent, which were considerably above the average, the performance of 1982 showed that the impact of world recession was gradually being felt and the regional strategy objectives appeared increasingly difficult to attain in the absence of substantial improvement in the world economic conditions.

During the first year of the third Development Decade the growth rates of those developing ESCAP economies following export-led growth strategies were the highest in the region and much above the world average.

Table 5. Average annual growth rates of production by sector in selected ESCAP countries (1960-1970, 1970-1978 and 1960-1978) (Percentage)

Country group and country	Period	Agriculture	Industry	Services	GDP a/
Developing countries					
Afghanistan	1960-1970	-0.1	7.8	5.3	1.8
	1970-1978	2.2	5.2	5.7	3.9
	1960-1978	0.9	6.7	5.5	2.6
Bangladesh	1960-1970	1.9	6.1	3.0	1.7
	1970-1978	1.6	7.4	5.1	3.6
	1960-1978	1.8	6.7	4.0	3.0
Burma	1960-1970	7.0	6.0	4.4	5.1
	1970-1978	4.3	4.6	2.5	3.3
	1960-1978	5.8	5.4	3.5	4.7
Fiji	1960-1970	2.8	4.5	7.3	4.9
	1970-1978	2.7	2.9	8.0	5.4
	1960-1978	2.7	3.8	7.6	4.9
Area of Hong Kong	1960-1970	0	11.8	9.9	9.7
	1970-1978	-12.1	7.0	9.8	8.2
	1960-1978	-6.0	9.7	9.9	9.2
India	1960-1970	1.8	5.1	4.0	3.5
	1970-1978	1.8	4.4	4.3	3.2
	1960-1978	1.8	4.8	4.1	3.2
Indonesia	1960-1970	1.9	5.8	4.4	3.6
	1970-1978	3.9	11.0	8.7	8.0
	1960-1978	2.8	8.1	6.2	5.5
Iran	1961-1970	4.1	13.0	10.4	10.9
	1970-1978	3.3	3.4	11.8	5.8
	1961-1978	3.7	8.4	11.0	8.5
Republic of Korea	1960-1970	4.4	16.5	8.6	8.9
	1970-1978	4.0	16.7	9.3	10.2
	1960-1978	4.3	16.6	8.9	9.3
Malaysia	1960-1970	6.8	9.0	5.1	6.6
	1970-1978	5.6	8.5	8.6	7.7
	1960-1978	6.2	8.8	6.6	7.2

Table 5. (continued)

Country group and country	Period	Agriculture	Industry	Services	GDP a/
Pakistan	1960-1970	5.3	9.8	6.8	7.1
	1970-1978	2.1	4.3	5.9	4.1
	1960-1978	3.9	7.3	6.4	5.7
Philippines	1960-1970	4.8	6.4	5.6	5.3
	1970-1978	4.8	8.3	5.4	6.4
	1960-1978	4.8	7.3	5.5	5.8
Singapore	1960-1970	3.7	14.4	7.9	9.7
	1970-1978	2.3	9.3	9.4	9.3
	1960-1978	3.1	12.1	8.5	9.4
Sri Lanka	1960-1970	4.7	7.6	6.0	5.8
	1970-1978	2.2	5.7	4.7	4.9
	1960-1978	3.6	6.8	5.4	4.9
Thailand	1960-1970	5.3	10.5	8.3	7.9
	1970-1978	5.9	11.6	7.7	7.9
	1960-1978	5.5	11.0	8.0	7.9
Centrally planned economies					
Mongolia	1960-1970	3.5	5.6	0.6	2.6
	1970-1978	2.8	7 2	6.6	5.9
	1960-1978	3.2	6.3	3.3	4.1

Source: UNIDO.

Table 6. Percentage change in GDP in selected ESCAP countries

	1980	1981	1982
Afghanistan	-	1.5	-
Bangladesh	2.8	6.8	0.3
Burma	7.8	6.7	5.9
People's Republic of China	6.9	3.0	4.0
Area of Hong Kong	9.8	11.0	4.0
India	7.9	4.6 - 5.5	2.5 - 3.0
Indonesia	7.0	7.6	4.0 - 6.0
Iran	-12.0	1.0	-2.0
Malaysia	7.8	6.9	3.9
Nepal	-5.2	3.3	4.1
Pakistan	7.3	6.1	6.6
Philippines	4.9	3.8	2.6 - 2.8
Republic of Korea	-6.2	7.1	6.00
Singapore	10.3	9.9	5.0 -7.0
Sri Lanka	5.8	5.8	5.0
Thailand	5.8	7.6	5.0

Source: UNIDO.

The area of Hong Kong with 11 per cent attained the highest rate of GDP growth in 1981, surpassing the 9.8 per cent record achieved in 1980, Singapore's growth rate of 10.3 per cent in 1980 fell only slightly to 9.9 per cent in 1981. The Republic of Korea recovering from the dramatic economic slowdown of 1979-1980 achieved a GNP increase of 7.1 per cent in 1981. The high rates of growth of these economies indicate that the industrial restructuring programme that they had introduced in the late 1970s brought about positive changes.

However, these adjustment measures were not sufficient to fully compensate the rapidly deteriorating conditions in the world economy or to cope with the changing trade policies of the region's major trading partners. This is suggested by the sharp decline in the export growth rate of Singapore from 36 per cent in 1980 to 6.2 per cent in 1981 and by the slowdown in the rate of growth of the area of Hong Kong from 30 per cent in 1980 to 10.3 per cent in 1981.

The worsened external financial situation in all the countries following export-led growth strategies in 1980 and 1981 had a serious negative influence on their overall economic performance in 1982. According to a preliminary official estimate the GDP rate of growth fell in 1982 to 4 per cent in the area of Hong-Kong, 5 to 7 per cent in Singapore and 6 per cent in the Republic of Korea.

For Malaysia in 1980 the GDP growth rate was still high at 7.8 per cent. The economy, however, in 1981, was hit by sharp set-backs in the prices of different products and Malaysia's rate of GDP growth slippped to 6.9 per cent in 1981 and further down to an estimated 3.9 per cent in 1982.

For Indonesia the rate of GDP growth in 1980 and 1981 was 7 per cent and 7.6 per cent respectively. In the Philippines the GDP growth rate slowed to 3.8 per cent in 1981 as compared to 4.9 per cent in 1980.

For Sri Lanka the economic growth rate during the first two years of the 1980s was high at 5.8 per cent per annum. The estimated growth rate in 1982 was around 5 per cent.

The rate of GDP growth in Thailand was 7.6 per cent in 1981 and the estimated rate of GDP growth was 4.5 per cent in 1982.

India achieved a very substantial GDP growth rate of 7.9 per cent in 1981/82. The agricultural growth rate for India was particularly impressive in 1980/81 and in 1981/82 averaging 9.2 per cent.

For Bangladesh, 1981 can be considered successful in terms of economic growth. GDP increased by 6.8 per cent with agricultural production rising by 8.1 per cent and industrial output by 14.6 per cent.

Pakistan registered a growth rate of 6.1 per cent in GDP in 1981/82, agricultural production and industrial output showed growth rates of 7.8 per cent and 6.7 per cent respectively.

2.2 Review of progress in the main sectors of economic activity

2.2.1 Agriculture

The agricultural sector in the developing ESCAP region performed well in 1981. The total agricultural output increased by 4.5 per cent against the 3.5 per cent set as the average annual growth target in the regional strategy. Despite considerable progress made in achieving self-sufficiency in food-grains production, the ESCAP countries in 1981 still imported about 60 million tons of cereals to meet the deficits and build up stocks.

2.2.2 Industry

The development of the manufacturing industries in the developing ESCAP region in the early 1980s displayed a somewhat unusual pattern as compared to the overall economic performance in the region. In 1980, the rate of growth in the manufacturing industries was only 0.8 per cent while GDP increased by more than 5 per cent. In 1981, manufacturing growth accelerated recording a 5.2 per cent increase. At the same time the overall economic growth rate was maintained at the same rate as in the previous year. Only in 1982 did the regional indicators of overall economic performance and those of manufacturing decline simultaneously and substantially.

It appears that the negligible average rate of manufacturing growth in 1980 was caused by a drastic production slowdown in only 2 countries of the region. These countries are India and the Republic of Korea which accounted for almost half (29 per cent and 17 per cent respectively) of the region's manufacturing outputs. In 1981, the situation was somehow different. India displayed formidable industrial recovery achieving the growth rate of 7.9 per cent and negative growth in the Republic of Korea was replaced by a 10.6 per cent increase in industrial production. At the same time, industrial activity in other countries of the region, although still relatively high, slowed down significantly. This related to several countries of South-East Asia particularly Indonesia, Malaysia, the Philippines and Singapore. In 1982, the industrial production in all the countries of the region diminished drastically. The growing need for flexible industrial adjustments to changing

conditions in the external and internal market on the one hand and the diminishing possibilities of achieving this during the period of economic slump on the other, pose major difficulties for the industrial development of the ESCAP region.

The problems of structural transformation in the industrial development of the region poses new questions and challenges. While there is no ready prescription as to how these difficulties can be resolved, identification of the emerging problems and prospects is very much necessary for determining the directions of the restructuring process.

During the 1960s and 1970s many developing ESCAP countries passed through the fundamental transformation from the traditional sectoral structure of GDP with the largest share occupied by agriculture and the lowest by the industry, to a more advanced structure with the largest share in the services sector followed by industry and agriculture. The share of industry in GDP at the end of the last decade was much larger than the industries' share in employment (34 per cent and 13 per cent respectively), indicating that the production effect of structural changes was much stronger than its employment effect.

3. REVIEW OF THE STEEL DEVELOPMENT SECTOR

Every developing country desires to build up its own heavy industry because it constitutes a vital industry base which is necessary to maintain the rapid pace of industrial development. Without any heavy industry of their own, the developing countries have to depend on others for supply of machinery and industrial raw materials and intermediate inputs. With a base of heavy industries the developing countries not only strengthen and enlarge their industrial base for the accelerated growth for other industries but also enhance technological progress for a new direction.

The industrialized countries of the world have been through a period of very low economic growth. This has resulted in stagnation and recession of steel demand. The causes of the mid-1970s recession were manifold cyclic factors combined with changes in the economic structure of the industrialized countries and with the breakdown of the international monetary system. The increases in the price of oil and the related general increase in energy prices created an economic depression of considerable dimension.

The world economy is going through a phase of adjustment to the changed conditions. During this period of adjustment the demand for steel has remained slack. Two-thirds of the steel use in industrialized countries is investment related and as the economies are stagnating investment is at a low level. Furthermore, the characteristics of investment have changed from investment for capacity expansion which is steel intensive to investment for productivity increase which is much less steel intensive. In view of these considerations, it is expected that steel demand in industrialized countries during the 1980s will grow at a very low rate. The relatively high growth rates of steel used in developing countries which were attained in the 1970s and remained at about 10 per cent a year cannot be maintained in the 1980s. A growth rate of 4 to 5 per cent for the year would be quite realistic. This means that the dynamics of growth of steel production and also of production in general will shift from the developed to the developing countries.

Even when iron and steel production in the developing countries is increasing at a more sustained rate than in the market economy countries, this production is still at an extremely low level. The developing countries are still far away from meeting their own requirements from their own production. One can distinguish various categories of countries according to the period in which their first development of their iron and steel industry was established. Amongst the fifteen countries for which the study is being undertaken India is the only country which had an iron and steel production of its own prior to 1950.

Group two consists of those countries where the first iron and steel production dates from the 1950s. The Philippines and the Republic of Korea figure in this group. Group three consists of those countries where the first iron and steel installations date from the end of the 1960s and the beginning of the 1970s. The area of Hong Kong, Indonesia, Iran, Malaysia, Pakistan, Sri-Lanka and Thailand would belong to this group. Group four consists of those countries where the first iron and steel installation started after the 1970s and is under construction or in the project stage. Singapore would belong in this group also. Afghanistan, Burma and Nepal would also figure in this group.

In the case of Japan, investments in plant and equipment by the steel industry in 1984 totalled 665.7 billion yen (on a construction basis as of February 1985), down 24.3 per cent from 879.1 billion yen in the preceeding year of 1983. The following table shows capital investment by the steel industry, 1974-1984.

Investments were focussed on rationalization and energy saving measures, repairs of blast furnaces and replacement of facilities aimed at lowering production costs and improving the quality of products.

Table 7. Capital investment by the steel industry, Japan, 1974-1984[a/]

Fiscal Year	Total of the steel industry (A) (billion yen)	All industries[b/] (B) (billion yen)	Steel industry (A/B) (percentage)
1974	892.2	6,408.4	13.9
1975	1,147.4	5,998.5	19.1
1976	1,264.6	6,241.4	20.3
1977	684.1	6,725.2	10.2
1978	580.5	7,389.9	7.9
1979	618.3	8,035.7	7.7
1980	606.8	9,787.7	6.2
1981	792.2	10,706.3	7.4
1982	1,031.9	10,925.6	9.4
1983	879.1	11,338.7	7.8
1984	665.7	12,366.9	5.4

a/ Investments are on a construction basis.

b/ Figures are the totals for the industries under MITI's jurisdiction.

Source: Industrial Structural Council, MITI.

This view is shared by the IISI as shown in the following table.

Table 8. Industrialized and developing market economies liquid steelmaking capacity
(million metric tons)

	1974	1980	1990
Western Europe	203	223	181/191
North America	156	152	136/142
Japan	126	142	130/135
Developing countries	33	60	104/116
Others	15	18	20/26
Total	533	595	571/610

Source: IISI, October 1984.

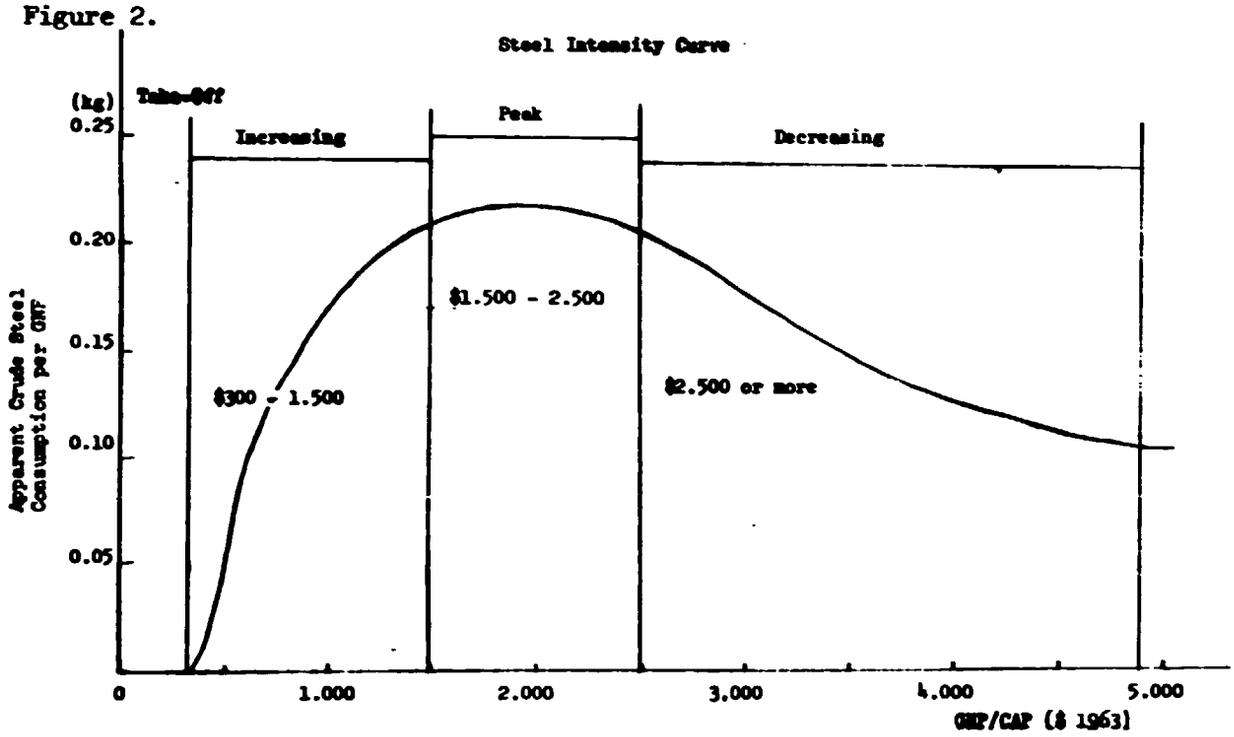
3.1 International comparisons

In 1980, the total production of iron and steel products (in terms of crude steel equivalent) in the world was 716 million tons. Compared with the production level in 1970, i.e. 598.5 million tons, this figure indicates an increase of 119.2 million tons in iron and steel production in the world during the last decade.

The developing countries started to strengthen their production of iron and steel products in the 1970s when the production of iron and steel in the developed countries turned stagnant or declined. Among those countries which have shown a striking increase in iron and steel production during the last decade are the Republic of Korea (increased by 17.1 times), Taiwan Province of China (increased by 11.3 times), Brazil (increased by 2.8 times), Democratic People's Republic of Korea (increased by 2.6 times), and the People's Republic of China (increased by 2.1 times). On the other hand, the United States (declined by 15.4 per cent), the Federal Republic of Germany (declined by 2.7 per cent), France (declined by 2.6 per cent), Luxemburg (declined by 15.5 per cent), and Sweden (declined by 23 per cent) are among those countries which showed a large decrease in the iron and steel production in the 1970s.

Differences in the demand structure between those developing and developed countries seem to be among the major factors which explain the above mentioned changes in quantitities of production in these countries. It is a common view that the demand for steel products increases along with the process of economic development. The theoretical framework for an empirical analysis in the form of a steel intensity curve is available which gives the functional relationship between the economic development and steel demand. The steel intensity is defined as the ratio of apparent steel consumption to gross national product (AC/GNP). It is assumed that a change in steel intensity relative to a change in income is directly related to the level of income. The IISI had divided the steel intensity (SI) curves into four stages according to the stages of economic development (figure 2).

Figure 2.



Source: IISI

(a) The stage of sharp upward sloping SI curve: As the per capita GNP approaches US$ 300 per year (1973 prices), the demand for iron and steel products increases almost vertically. When this level is reached in per capita income, a process of rapid industrialization develops, with a consequent increase in investment, in infrastructure, pushing up steel consumption rapidly, and this results in a rapid rise of steel intensity. In the take-off stage in the economic development, it is generally observed that the demand for iron and steel products rises almost vertically.

(b) The stage of easy upward sloping SI curve: When the GNP per capita falls in the range US$ 300 to US$ 1,200 per year, the growth rate of demand for iron and steel products slows down but still exceeds the growth rate of GNP. The demand for non-flat products exceeds the flat steel products since the steel demand increases rapidly in the construction sector in this stage.

(c) The stage of horizontal SI curve: When the GNP per capita falls in the range US$ 1,200 to US$ 2,000 per year, the growth rate of demand for iron and steel products comes close to that of the GNP. Consequently the SI curve becomes horizontal. The ratio of non-flat products to flat products demand is reversed in this stage since steel demand is increased for the manufacture of cars, household equipment, electric machinery and steel ships.

(d) Developing countries and the conditions for take-off: The analysis of steel intensity of developing countries by IISI shows that the level of GNP per capita in itself is not an indication whether a country is at the starting point nor whether it is approaching this point. Other factors have to be taken into account as the level of steel intensity varies considerably between countries at identical income levels per head.

IISI made the indicators of the conditions for take-off as follows:

(i) GDCP (Gross Domestic Capital Formation) at a level of at least 20 per cent of GNP;

(ii) More than 20 per cent of GDP originating in manufacturing, less than 30 per cent in agriculture;

(iii) More than 10 per cent of manufacturing consisting of capital goods;

(iv) More than 700 tons of steel consumed per US$ 1 million of GDCF.

The analysis of more detailed steel intensity concerning developing countries concludes that an essential element for taking-off is whether capital formation for industrialization is developed smoothly within the overall framework of the economy.

(e) The stage of downward sloping SI curve: When the per capita GNP exceeds US$ 2,000 per year, the rate of growth of the demand for the iron and steel products becomes less than that of GNP and as a result the SI curve slopes downward. Two principal causes of this decline in steel intensity are changes in the structure of the economy, i.e. changes in the relative importance of

activity of steel-using sectors in the total economic activity and changes in steel usage within individual sectors (either changes in steel use per unit of sector output or changes in the product pattern of output in a given sector).

In the developing countries, the implementation of large-scale infrastructure projects and the construction of light and heavy chemical industry plants - in accordance with the positive development policies in these countries - brought about a large increase in the demand for iron and steel products. This demand for iron and steel products in the developed countries has been satisfied in the past economic development. Therefore, there is a little room left to further develop the demand for iron and steel products.

Taking advantage of the increasing demand for iron and steel products, some developing countries like the Republic of Korea, Taiwan Province of China, Mexico and Brazil assigned first priority to the iron and steel industry in their strategy of economic development. Accordingly, policies protecting and promoting domestic iron and steel industries were taken and, thus, increased the supply of these products.

In the 1980s, the level of crude steel production was 9.51 million tons in India, 8.61 million tons in the Republic of Korea, 4.22 million tons in Taiwan Province of China, 0.12 million tons in the area of Hong Kong, 0.34 million tons in Singapore, 0.20 million tons in Malaysia, 0.40 million tons in the Philippines, 0.45 million tons in Thailand, and 0.36 million tons in Indonesia. These figures are quite small compared with the total world production in the same year, viz. 741.79 million tons.

However, in the historical dimension changes in the production level of iron and steel in these countries were very large. Compared with 1971, the production level in 1980 was 36 times larger in Indonesia, 18.2 times larger in the Republic of Korea, 9 times larger in Taiwan Province of China and 3 times larger in the Philippines. These figures substantially exceed the pace of growth of the world iron and steel production (1.23 times) in the same period, and seem to reveal results of various policies in favour of the iron and steel industries in these countries.

Table 9 gives the world crude steel production by region for 1970 and 1980.

Table 9. World crude steel production by region

	Production 1,000 metric tons		Share Percentage	
	1970	1980	1970	1980
Western Europe	161,911	161,190	27.1	22.5
U.S.S.R.	155,968	208,550	26.1	29.1
Eastern Europe				
North America	133,320	118,890	22.3	16.6
Latin America	13,181	29,150	2.2	4.1
Africa	5,712	11,400	1.0	1.6
Asia	121,406	180,700	20.3	25.2
Oceania	7,066	7,820	1.2	1.1
OECD member countries	393,391	395,670	65.7	55.1
Japan	93,322	111,406	15.6	15.5
U.S.A.	119,310	100,900	19.9	14.1
European Community	138,070	127,760	23.1	17.8
Developing countries	29,205	70,640	4.9	9.8
Total	422,596	466,310	70.6	65.0
U.S.S.R.	115,886	149,100	19.4	20.8
Eastern Europe (six countries)	40,082	59,450	6.7	8.3
People's Republic of China and Democratic People's Republic of Korea	20,000	42,840	3.3	6.0
Total	175,968	251,390	29.4	35.0
World Total	598,500	717,700	100.0	100.0

Source: JISF

Table 10 gives the details regarding the changes of crude steel production from 1974 to 1984 for Asian, South-East Asian, African, Latin American, Middle East and the ASEAN countries, which are composed of Indonesia, Malaysia, the Philippines, Singapore and Thailand and also the share of the developing Asian countries in the world steel production.

Table 10. Crude steel production in developing countries, 1974-1984
(Thousand metric tons)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Total industrialized countries	463,348	391,221	415,601	399,788	420,645	442,633	407,094	401,990	338,275	343,646	375,940
Total European C.P.E. countries	185,057	192,623	198,960	204,169	211,083	209,444	209,158	206,127	203,450	210,025	213,930
Developing countries:											
Argentina	2,353	2,208	2,410	2,684	2,782	3,199	2,687	2,526	2,913	2,942	2,630
Brazil	7,515	8,387	9,253	11,253	12,205	13,893	15,309	13,226	12,995	14,671	18,391
Central America	10	10	13	62	64	98	100	105	43	45	102e
Chile	634	508	503	559	616	642	746	657	483	611	684
Colombia	333	391	356	330	390	354	420	396	409	463	499
Ecuador	-	-	-	-	-	-	16	26	27	22	19
Mexico	5,138	5,272	5,298	5,601	6,775	7,117	7,136	7,663	7,055	6,917	7,482
Panama	-	-	-	-	-	-	6	50	50	50	25e
Peru	450	432	346	379	374	379	447	360	275	289	323
Trinidad & Tobago	-	-	-	-	-	-	-	45	219	215	186e
Uruguay	14	16	16	19	7	16	18	14	20	38	44
Venezuela	1,058	1,100	937	854	859	1,475	1,975	2,030	2,215	2,320	2,745
Cuba	240	300	296	302	300	300	300	300	300	300	300e
Total Latin America	17,745	18,624	19,428	22,043	24,372	27,473	29,180	27,398	27,005	28,883	33,430
Algeria	173	221	356	410	380	242	384	522	550	700	700e
Egypt	500	500	500	600	600	800	800	900	950	850	850e
Nigeria	15	14	15	15	15	15	22	22	90	182	187
Tunisia	131	127	103	156	160	176	178	173	107	163	165e
Zimbabwe	491	524	733	734	778	740	805	691	538	647	800e
Other Africa(E)	60	60	60	60	60	65	70	70	70	75	75
Total Africa	1,370	1,446	1,767	1,975	1,993	2,038	2,257	2,378	2,305	2,617	2,777
Iran	567	551	549	1,825	1,300	1,430	1,200	1,200	1,200	1,200	1,200e
Qatar	-	-	-	-	127	396	396	469	495	469	478
Saudi Arabia	-	-	-	-	-	-	.	-	-	400	842
Other (E)	85	70	65	51	55	170	170	180	200	200	200
Total Middle East	652	621	614	1,876	1,482	1,996	1,766	1,849	1,895	2,269	2,720
Bangladesh	74	76	90	108	120	125	131	134	78	80	80e
Hong Kong (E)	120	120	120	120	120	120	120	120	120	120	120
India	7,069	7,991	9,364	10,009	10,009	10,126	9,514	10,780	10,997	10,737	10,512
Indonesia	80	100	139	250	225	305	360	500	500	800	1,000
Malaysia	182	183	190	194	203	207	210	210	210	350	350e
Philippines	233	309	350	357	276	397	330	350	350	200	250e
Singapore	194	196	203	215	281	293	340	263	359	305	362
Republic of Korea	1,947	1,994	3,511	4,346	4,969	7,610	8,558	10,753	11,758	11,915	13,033
Taiwan Province of China	597	680	1,098	1,710	3,426	3,186	3,417	3,157	4,152	5,031	5,010
Thailand	326	251	281	309	346	440	450	300	350	350	350e
Other (E)	200	200	200	250	230	225	225	220	250	250	600e
PR China	21,120	23,903	20,459	23,740	31,780	34,484	37,121	35,604	37,160	40,020	43,260
DPR Korea (E)	3,200	2,900	3,000	4,000	5,080	5,400	5,800	5,500	5,800	6,100	6,500e
Total Asia (A)	35,342	38,903	39,005	45,608	57,155	62,918	66,576	67,891	72,084	75,758	81,527
World Total (B)	703,514	643,438	675,375	675,459	716,730	746,502	710,324	716,031	707,633	645,014	663,198
A/B(%)	5.0	6.0	3.7	6.7	7.9	8.4	9.2	9.5	11.1	11.4	11.4

Note: E = All years estimated
e = 1984 estimated

Source: I.I.S.I. 1983

3.2 World apparent steel consumption

The world apparent steel consumption in 1979 was estimated at 747.5 million tons. Of this total, one-half was consumed by developed countries, one-third by centrally planned economies and about 10 percent by developing countries. In 1983, the world steel consumption declined to 662 million tons. Of this, 45.5 per cent were consumed by industrialized countries, 14.4 per cent by developing countries and 40.1 per cent by centrally planned economies.

The average steel consumption per capita in developed countries was about 500 kg per year. On the other hand, the average steel consumption per capita in developing countries was only 50 kg per year, or about 10 per cent of that in developed countries.

With regard to the level of apparent steel consumption in Asian countries, Japan recorded 78 million tons, the Republic of Korea 7 million tons, Taiwan Province of China 5.5 million tons, the area of Hong Kong 1.44 million tons, and the ASEAN countries ranged from 1.3 to 2 million tons in 1979. In terms of per capita apparent steel consumption, Japan and Singapore stood at 673 kg, larger than the world average, while the Republic of Korea was at 265 kg, Taiwan Province of China and the area of Hong Kong at 320 kg, Malaysia at 100 kg, Thailand at 43 kg, the Philippines at 35 kg, and Indonesia at 10 kg. In general, the level of per capita consumption of iron and steel in Asia is still far behind the world average and, thus, indicates prospects for upward trends in the future.

The high level of per capita steel consumption in Singapore (673 kg/year) includes imported iron and steel products which are to be re-exported to Indonesia without any kind of processing. This level does, therefore, not truly represent the actual domestic consumption of iron and steel products of Singapore, and estimating that about 25-30 per cent of iron and steel products imported to Singapore are re-exported to Indonesia without any or with a very slight degree of processing, the actual per capita steel consumption in Singapore must be about 400 kg/year.

Table 11 gives the world apparent steel consumption for the period (1974-1983) by region.

Table 12 gives Asia's apparent steel consumption for the period 1971-1982.

Table 13 gives the per capita apparent steel consumption during the period 1971-1982 for the Asian and South East Asian countries.

3.3 Country situation

From the review of the steel production and consumption data by region, it is clear that as far as the potential and opportunities for development of the iron and steel industry are concerned, the developing ESCAP countries are favourably placed. In the recent past there has been a growing awareness amongst these countries to exploit their natural resources. The individual status of development of the steel industry is discussed in the subsequent paragraphs.

3.3.1 Afghanistan

Afghanistan does not have any iron and steel production capacity of its own and has been meeting all its requirements through imports. Based on the information available, the imports of the iron and steel products were US$ 1,514,000 in 1970 which increased to US$ 3,612,000 in 1975 and to US$ 7,028,000 in 1977. The bulk of the imports were for steel bars, galvanized sheet and tubes and fittings.

Table 11. World apparent steel consumption, 1974-1983)
(Million metric tons crude steel equivalent)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Japan	78.6	67.6	65.2	65.1	67.9	78.5	78.8	72.3	70.1	66.2
EEC	121.6	99.7	113.1	105.5	103.8	113.9	108.3	99.3	91.7	89.2
Other Western Europe	38.3	35.2	34.8	35.3	33.4	30.9	32.1	31.4	30.5	29.7
United States	149.7	113.7	127.8	138.5	146.4	142.6	118.4	128.2	92.1	94.9
Canada	15.8	13.0	12.6	12.8	13.6	14.9	13.8	14.4	10.5	11.3
South Africa	6.3	6.8	5.3	4.5	5.1	5.5	6.4	6.6	5.8	5.3
Oceania	9.2	6.2	6.4	5.8	5.7	7.3	7.2	7.4	6.8	5.6
Total industrialized countries	419.5	342.2	365.2	367.5	375.9	393.6	365.0	359.6	307.5	302.2
Latin America	29.7	29.8	26.9	30.9	31.3	32.5	36.8	34.4	29.0	23.2
Africa except South Africa	6.4	6.3	6.4	8.8	8.8	9.4	10.7	11.1	11.1	12.0
Middle East	11.6	13.4	15.1	14.1	13.6	16.7	16.1	16.2	16.7	17.0
Asia except Japan, China, DPR Korea	21.6	21.9	23.6	29.2	32.8	38.1	38.2	41.2	41.1	43.0
Total developing countries	69.3	71.4	72.0	83.0	86.5	96.7	101.8	102.9	97.8	95.2
Total market economies	488.8	413.6	437.2	450.5	462.2	490.3	466.8	462.5	405.3	397.4
USSR and Eastern Europe	188.9	195.0	200.9	205.9	214.2	211.3	209.6	205.9	204.6	211.0
China and DPR Korea	34.1	34.0	29.9	34.2	47.9	50.9	49.5	45.3	48.1	55.0
Total World	711.8	642.6	668.0	690.6	724.5	752.6	725.9	713.8	658.0	663.4
Unallocated	-2.8	2.8	8.4	-15.2	-7.3	-5.9	-9.7	-6.1	-12.8	-0.8
World Steel Production	709.0	645.4	676.4	675.4	717.2	746.7	716.2	707.7	645.2	662.6

Source: IISI 1984

Table 12. Asia apparent steel consumption, 1971-1982
(Thousand metric tons crude steel equivalent)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Japan	57,699	68,888	87,181	75,753	64,736	60,176	58,243	61,507	73,209	73,442	65,445	63,733
Republic of Korea			3,396	4,222	3,120	5,416	5,468	6,747	7,007	5,645	5,314	5,324
Taiwan, Province of China	1,200	1,300	1,675	2,544	1,666	2,488	3,451	4,747	3,892	5,611	4,553	5,060
Area of Hong Kong	654	579	766	784	725	1,155	1,180	1,140	1,102	1,441	...	...
Singapore	942	912	1,430	1,762	1,619	1,342	1,298	1,271	1,191	1,701	...	...
Thailand	876	827	1,301	1,734	1,103	1,377	1,376	1,268	1,479	-	...	...
Philippines	814	798	1,206	1,214	950	1,203	1,415	1,567	1,574	1,311	...	...
Malaysia	434	466	858	987	744	840	636	804	944	1,113	...	...
Indonesia	595	715	1,130	1,280	1,448	1,382	1,210	1,360	1,327	1,945	...	...
PR China	24,500	25,600	29,250	30,600	32,000	27,033	32,544	42,706	44,487	43,262	39,401	42,110
PR Korea	1,816	2,042	3,059	3,442	3,378	3,029	3,165	3,233	5,442	5,869	...	...
Burma	107	83	79	81	115	96	47	43	76	58	...	...
Bangladesh	...	79	187	103	93	102	79	142	234	261	...	...
Afghanistan	22	17	13	12	21	26	24	19	18	1	...	...
Pakistan	662	382	367	433	537	497	673	576	778	628	...	...
Sri Lanka	123	36	64	60	62	76	26	122	124	44	...	...
India	7,710	9,227	8,221	8,551	8,500	8,202	9,081	10,037	11,847	9,514	12,616	12,191

Note: Figures are different from the ones by the IISI because of the different methodology used.

Source: SEAISI (South East Asian Iron and Steel Institute), 1983, KOSA 1984.

Table 13. Per capita apparent steel consumption in Asian and South East Asian countries, 1971-1982 (kg crude steel equivalent)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Japan	551	643	802	688	580	534	512	535	637	629	561	538
Republic of Korea	46	57	103	126	85	151	150	182	187	148	183	135
Taiwan Province of China	80	85	108	160	103	151	205	277	223	315	251	274
Area of Hong Kong	162	142	184	184	166	264	262	247	225	284	...	...
Singapore	446	424	653	794	720	589	562	545	500	712	...	...
Thailand	23	21	33	30	26	32	31	28	22	-	...	...
Philippines	21	20	30	29	22	27	31	34	34	27	...	...
Malaysia	41	43	77	84	63	68	50	62	71	83	...	...
Indonesia	5	6	9	10	11	10	8	9	9	13	...	...
PR China	31	32	35	37	38	32	38	46	47	45	39	41
DPR Korea	127	139	203	223	213	186	190	189	311	328	...	...
Burma	4	3	3	3	4	3	1	1	2	2	...	...
Bangladesh	...	1	3	1	1	1	1	2	3	3	...	...
Afghanistan	1	1	1	1	1	1	2	1	14	1	...	...
Pakistan	6	6	5	6	7	7	9	8	10	8	...	...
Sri Lanka	10	3	5	4	4	5	2	9	9	3	...	...
India	14	16	14	15	14	13	15	16	18	14	19	17

Note: Figures are different from the ones by the IISI because of the different methodology used.

Source: SEAISI, 1984. KOSA, 1984.

The following table shows the import of the iron and steel products in terms of metric tons from 1973 to 1983.

Table 14. The import of iron and steel products
(Thousand metric tons)

1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
10	9	16	12	21	15	13	11	5	2	2

Source: E.C.E., Statistics of world trade in steel.

3.3.2 Bangladesh

The economy of Bangladesh is mainly agrarian in character. Over 90 per cent of the people live in villages and 75 per cent are directly dependent on agriculture. Bangladesh has a considerable potential for the development of steel capacity. It is expected that Bangladesh will have access to more sophisticated iron and steel production between 1985 to 1990.

Chittagoag Steel Mills (250,000 tons per year) is at present the only basic steel industry of the country. The plant went into operation in 1967. Necessary operational and maintenance personnel were trained in Japan and also locally by Kobe Steel Ltd., the supplier and erector of the plant. There are various rolling mills for bars, wire rod and tubes.

The crude steel production and the apparent steel consumption during the period 1972 to 1983 is given below:

Table 15. Crude steel production and apparent steel consumption, Bangladesh, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	65	79	1.1
1973	68	187	2.5
1974	74	103	1.3
1975	76	93	1.2
1976	90	102	1.3
1977	108	79	1.0
1978	120	100	1.2
1979	125	130	1.5
1980	137	150	1.7
1981	134	150	1.7
1982	78	100	...
1983	80	100	...

Source: International Iron and Steel Institute, 1984.

Based on the above, the average annual growth rate of steel consumption was 8 per cent during 1976-1981 and 7.4 per cent during 1972-1981. Bangladesh is expected to have a nominal steelmaking capacity of 257,000 tons by 1986.

3.3.3 Burma

At present only a 40,000 tons DR plant is in operation in Burma. In 1979, Danieli was asked by the Burmese Government to prepare a feasibility study for a small integrated steel works based on DR. The first phase of the plant was started in October 1981. The first stage of DR is a module with a capacity of 20,000 tons per year. The second module will also have a capacity of 20,000 tons per year. It is planned that in the initial stage the plant shall produce only pig iron to supply many small foundries. The crude steel production and apparent steel consumption in the country during the period 1973 to 1983 are shown below:

Table 16. Crude steel production and apparent steel consumption, Burma, 1973-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1973	24	79	2.6
1974	31	81	2.7
1975	55	115	3.7
1976	41	96	3.0
1977	46	47	1.4
1978	37	43	1.3
1979	55	76	2.2
1980	47	58	1.6
1981	76	94	2.6
1982	72	88	...
1983	60	...	...

Source: Steel statistics of developing countries, IISI 1985

3.3.4 Malaysia

Malaysia is poised for a rapid economic and industrial growth accompanied by a balanced distribution of wealth among its population. Efforts are being made to effectively employ its huge energy and resource endowment for industrialization of the country. Practically all the output of industry comes from Peninsular Malaysia. While the production of fabricated metal products had been undertaken for some time, the country became a major user of primary iron and steel products with the commencement of production by the Malayawata Steel Limited in 1967. The growth of primary iron and steel production contributed significantly to the growth of output of the whole industry which reached US$ 276 million by 1974, an annual increase from 1968 of 35.3 per cent. The growth has been uniformly sustained in the subsequent years.

The effective capacity of the iron and steel production had never been large and up to 1980 not shown signs of any significant expansion. This situation changed from 1981 when crude steel output was estimated to have increased from 230,000 tons to 680,000 tons. By the end of 1982 the total

capacity was expected to increase to 926,000 tons with 250,000 tons coming from Malayawata and the Amalgamated Steel Mill respectively. Table 17 gives the details of the number of producers and the effective capacity in the Malaysian Iron and Steel Industry during the period 1978-1981.

The crude steel production and apparent steel consumption during the period 1972-1983 are given in table 18.

Table 19 shows the main types of crude steel produced. Most of the total output (76 per cent in 1980) is in the form of ingots, while practically all the remainder is in the form of continuous cast series. The latter, however, declined between 1979 and 1980.

Table 20 gives production figures for downstream products of the iron and steel industry.

The apparent steel consumption recorded an average annual growth rate of 13.8 per cent during 1976-1981 compared to a growth rate of 9.6 per cent during the period 1972-1981.

The Government of Malaysia is promoting steel expansion as a means of strengthening the Malaysian industrial base and providing for extensive manufacturing sector growth. Voest Alpine and Midrex have recently been awarded a contract to build a 600,000 tons per year DP Plant at Labuan. Nippon Steel Corporation has also been awarded a contract to build a 600,000 tons per year DR Plant at Terengganu. This plant is expected to be commissioned in 1984-85.

Table 17. Number of producers and effective capacity in the Malaysian iron and steel industry, 1978-1981

Type of product	Number of producers			Effective capacity 1,000 tons				Future additional capacity
	1979	1980	1981	1978	1979	1980	1981*	1,000 tons (Year)
Crude iron (excluding foundries)	1	1	1	120	120	...	...	600 (1983)
Crude steel (excluding foundries)	4	4	45	...	230	230	680	600 (1984)
Hot rolled non-flats:								
- Wire rods	2	2	2	...	120	150	150	
- Bars	5	5	6	260	260	260	310	230 (1982)
- Other light sections	5	5	6					
- Cold rolled flats	-	-	-	-	-	-	-	150
- Steel pipes and fittings	5	5	5	...	140	144		
- Wire	11	11	11	...	130	130	130	
Coated sheets:								
- Galvanized sheets	4	4	4	107	107	107	107	
- Tinplates	-	-	-	-	-	-	-	90 (1982)
Foundries:								
- Cast iron pipes and fittings	9	9	9	...	500	15	...	
- Other iron castings	212	212	212	...		n.a.	...	
- Steel castings	6	6	6	...	10	31	...	

* Estimated only.

Source: 1. Southeast Asia Iron and Steel Institute, "Steel Statistics for Member Countries", mimeo.

2. Communication from the Malaysian Industrial Development Authority.

Table 18. Crude steel production and apparent steel consumption, Malaysia, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	187	701	43
1973	180	1,047	60
1974	182	1,208	84
1975	183	851	72
1976	190	956	78
1977	194	1,013	80
1978	203	1,605	124
1979	207	1,907	141
1980	210	2,200	159
1981	210	2,250	158
1982	210	1,800	124
1983	350	2,130	145

Source: International Iron and Steel Institute, 1984

Table 19. Production of crude steel, by type, Malaysia, 1974-1980 (Thousand tons)

Year	Ingots	Continuous cast semis	Steel for casting*	Total
1974	110.0	47.6		157.7
1975	132.8	49.8		182.6
1976	120.2	68.6		188.8
1977	129.1	57.2	8.0	194.3
1978	128.2	67.0	8.0	203.2
1979	143.8	55.0	8.0	206.8
1980	138.6	35.8	8.0	182.4
Increase per annum 1974-80 (%)	3.9	-4.6	...	2.4

* Estimate only.

Source: SEAISI, 1980 MIDA.

Table 20. Production of goods of iron and steel and of downstream industries, Peninsular Malaysia, 1970-1980
(Number of units)

Year	Structural shapes and complete steel structures (tonne)	Iron and steel drums	Tins cans and metal boxes	Electric fans	TV sets	Household refrigerators	Bodies for: Motor coaches buses and vans	Bodies for: Lorries	Bodies for: Trailers	Assembly of: Passenger cars	Assembly of: Lorries	Assembly of: Vans	Assembly of: Buses	Assembly of: Other commercial vehicle
1970	8,252	926,063	250,198				397	508	224	20,957				
1971	11,446	956,436	236,871				348	663	109	23,528				
1972	16,108	1,141,916	244,285	139,631	59,439	31,236	250	497	34	24,703	2,285	2,769	75	992
1973	19,924	1,441,929	296,213	146,257	64,773	43,914	232	614	215	41,345	3,707	2,542	99	1,082
1974	17,318	1,381,461	303,517	166,539	77,986	48,014	424	762	185	52,891	5,692	3,219	182	2,230
1975	9,497	1,396,133	234,050	130,195	101,445	48,971	570	1,144	88	39,179	3,814	3,102	242	2,132
1976	10,155	1,420,249	235,653	175,728	107,775	61,830	416	1,239	28	44,231	3,387	2,273	457	2,000
1977	11,415	2,029,648	314,489	226,783	142,486	64,068	579	470	80	55,557	4,305	3,243	446	1,514
1978	14,413	2,093,130	368,184	320,945	150,108	88,681	816	1,075	231	62,298	5,148	4,103	770	1,583
1979	12,540	2,227,000	450,314	371,694	154,127	87,810	638	946	422	59,570	6,803	4,000	599	2,625
1980g/	12,490	2,742,000	436,620	392,485	156,353	123,006	804	1,482	527	77,263	10,255	6,818	446	3,914
% increase per annum	4.2	11.5	5.7	13.8	12.8	18.7	7.3	11.3	8.9	13.9	20.6	11.9	25.0	18.7

g/ Estimated from 10 months (January-October) data.

Source: MSB: PM

3.3.5 India

India achieved an economic growth rate of 3.3 per cent per annum during the period 1970 to 1980 compared to a figure of 3.5 per cent during 1975-1980. The industrial production and gross domestic capital formation registered an average annual growth rate of 4.1 per cent and 5.5 per cent during 1970 to 1980 and 4.7 per cent and 7.7 per cent during the period 1975 to 1980 respectively. The share of agriculture in GDP declined from 43 per cent in 1970 to 38 per cent in 1980.

The crude steel output and apparent steel consumption during the period 1972 to 1983 are shown below.

Table 21. Crude steel production and apparent steel consumption, India, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	6,856	9,227	16
1973	6,889	8,221	14
1974	7,069	8,700	15
1975	7,991	8,160	14
1976	9,364	8,240	13
1977	10,009	9,325	15
1978	10,099	10,840	17
1979	10,126	12,225	19
1980	9,514	12,000	18
1981	10,780	13,980	21
1982	10,997	13,530	20
1983	10,237	12,150	17

Source: International Iron and Steel Institute, 1984.

Steel consumption registered an average annual growth rate of 8 per cent during 1976-1981 compared to a growth rate of 4.5 per cent during 1972-1981.

India has a significant role to play in the development of the steel industry in the developing region. Among the developing countries, India is well-placed in respect of four major raw material sources, viz. iron ore,

manganese ore, coking coal and hydro-electric potential. With a crude steel production of 10.8 million tons in 1981, India contributed around 1.5 per cent to world steel production and ranked 4th among the developing countries and 17th in the world. Per capita steel consumption, however, remains low at around 20 kg compared to a world average of 162 kg. Besides, having an advantageous combination of low labour costs, abundance of raw materials, industrial and diverse market, the country has achieved significant degrees of self-reliance in equipment manufacturing, engineering, construction and development of technical and trained manpower in the steel industry. Viewed in this perspective, India holds the key to the development of the steel industry, especially among the developing countries.

The steel industry in India continues to face fundamental problems in deciding as to how to meet the needs of the potentially vast domestic market. The present population of nearly 700 million in 1981 will grow to about 825 million by 1990 and could reach 1 billion by the year 2000. India will need to increase its steel output by about 50 per cent by 1990 just to maintain its 1981 per capita output level of 20 kg. Any significant increase in its per capita output level will require substantial additions to its steel making capacities.

The Indian Government has long supported the expansion of the steel industry, particularly through the addition of large integrated steel works. In the early 1970s the steel industry in India moved away from large integrated steel plants to small mini steel producers, with the government issuing licenses for more than 200 plants. Through the second half of 1970, the mini steel plants were hit by acute power shortages throughout the country and inadequate availability of inputs such as scrap and electrodes. The Government has assisted the mini steel plants by obtaining ferrous scrap and other imported raw materials. The Government has also provided the mini steel plants with various loan packages and allowed them to diversify into alloy steel production and integrate forward by constructing finishing capacity. A potentially very favourable development for the mini steel sector has been the construction of sponge iron capacity. With India's substantial ore-reserves, additional sponge iron capacity will be an important element of the domestic steel industry by the end of the decade. The latest plans of the Indian Government are for a steel industry expansion primarily through integrated

steel plants. The Government of India plans to increase the capacity of integrated steel plants from a level of 11.4 million tons to about 23 million tons per year by 1989-1990. The expansion plans include modernizing and expanding existing works as well as building new green field sites. Among the modernization projects are the expansion of Bhilai and Bokaro Works to 4 million tons per year capacity each. The other large green field plant the Visakhapatnam Steel Project is scheduled to begin production by 1988.

With the maturity of the direct reduction process, it is expected that India will take advantage of its large iron ore reserves and expand the steel making capacity through the DR process route.

3.3.6 Indonesia

Iron and steel has been produced in Indonesia since quite some time. The products produced by this industry were generally in the form of simple agricultural tools. Amongst the steel producers, P.T. Krakatau steel is the largest. It is a government owned company located in West Java. The plant combines direct reduction of iron ore pellets with electric arc furnace steelmaking and is being constructed in a series of well defined phases. The phase-I programme includes a HYL process direct reduction plant with a rated capacity of 2,000,000 tons per annum. The second phase of this plant began production in 1978 and the last unit started production in 1981.

Krakatau Steel is continuing its growth and will play a major role in the development of the Indonesian iron and steel industry. Facilities for the production of flat rolled steel all of which is being currently imported, are now being constructed. In this phase of expansion, a second steelmaking and continuous casting plant is being installed for production of slabs. The slabs will subsequently be rolled in strips and coils. An extensive cold rolling mill at Cilegon is now being planned. This phase calls for construction of a hot strip mill, a cold rolling mill, a slabbing mill, a million ton capacity sheet plant, and doubling the capacity of the sponge iron unit to 2 million tons.

The crude steel output and apparent steel consumption during the period 1972 to 1983 are given in table 22.

The average annual growth rate in steel consumption was recorded as high as 17.5 per cent during 1976-1981 and 13.0 per cent during 1972-1981.

The present government policy is to place Krakatau Steel at the centre of the steel sector as the only integrated steel producer in Indonesia. The smaller electric furnace and finishing plants are being dispersed throughout the country. The Government has an important role to play to ensure the continued operation of Krakatau Steel which will make available adequate steel supplies to the ccuntry.

Table 22. Crude steel production and apparent steel consumption, Indonesia, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	30	1,030	6
1973	80	1,442	9
1974	80	1,470	10
1975	100	1,448	11
1976	139	1,612	10
1977	250	1,744	12
1978	225	1,964	14
1979	305	2,140	15
1980	360	3,060	21
1981	500	3,220	21
1982	500	2,700	17
1983	800	2,500	16

Source: International Iron and Steel Institute, 1984

The government's recent import restrictions and price controls have improved domestic profit margins. This improved financial outlook has resulted in stepped up expansion plans. It is proposed to install a 150,000 tons per year mini steel mill at Surabaya in the near future. Demand for iron and steel products has increased drastically with the increased construction of physical facilities. Considering an average growth of 7.57 per cent the projected demand for crude steel during the period 1981-1985 has been calculated and is given below:

Table 23. Projections of demand for crude steel, Indonesia, 1981-1985

Year	Population projection million	Construction sector projection (billion Rp)	Per capita steel demand kg/capita	Total crude steel demand 1,000 tons
1981	151.2	676.1	19.1634	2,898
1982	155.0	272.3	20.1600	3,125
1983	158.9	782.3	21.2042	3,369
1984	162.9	841.5	22.3048	3,633
1985	167.0	905.2	23.4624	3,918

Steel production had increased from 10,000 tons in 1970 to 150,000 tons in 1977 an average annual increase of 47.24 per cent. If the average annual increase in production remains at 47.24 per cent by 1985, crude steel production will reach approximately 3.3 million tons.

From the projections of demand and actual production, it can be seen that Indonesia is still short of sufficient crude steel to fulfil demand. Thus, crude steel has to be imported, though in increasingly smaller amounts. Details of demand and production projects for crude steel for 1981-1985 are given below:

Table 24. Difference between production and demand for crude steel, 1981-1985

Year	Production projection 1,000 tons	Demand projection 1,000 tons	Difference between production and demand 1,000 tons
1981	705	2,898	- 2,193
1982	1,038	3,125	- 2,087
1983	1,528	3,369	- 1,841
1984	2,250	2,633	- 1,383
1985	3,314	3,918	-604

Source: Institute of Developing Economies Tokyo, 1982.

3.3.7 Iran

The details of Iran's crude steel production and apparent steel consumption during the period 1972 to 1983 are given in table 25.

Steel consumption registered an average annual growth rate of 8.2 per cent during 1976-1981 compared to a growth rate of 6.6 per cent during 1972-1981.

Table 25. Crude steel production and apparent steel consumption, Iran, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	...	1,804	59
1973	240	2,568	82
1974	567	3,520	93
1975	551	5,750	163
1976	549	5,425	147
1977	1,825	6,070	171
1978	1,300	7,225	199
1979	1,430	3,650	85
1980	1,200	4,475	90
1981	1,200	3,650	90
1982	1,200	3,830	94
1983	1,200	5,360	129

Source: International Iran and Steel Institute, 1984

Isphahan with a 0.65 million tons BOF plant and Ahwaz are the two potential sites for capacity expansion. A 3 million tons per year DR based steel plant is being built by Italy at Bandar Abbas, which is reportedly progressing. It is expected that the Iran will have a steel production capacity of 1,970, 2,770 and 5,170 thousand tons by 1984, 1986 and 1990 respectively.

3.3.8 Republic of Korea

The iron and steel industry in the Republic of Korea originally dated back to 1918 when Kyumipo Iron Works was constructed but the contemporary iron and steel industry in the Republic of Korea is spearheaded by the construction of Pohang Iron and Steel Company in 1973, thus strengthening the foundation for iron and steelmaking comparable to those in the industrialized countries, although the industry in a modernistic sense was being deployed in 1960. The Republic of Korea has achieved remarkable progress in two decades following the Korean war. The steel industry has registered an impressive growth since the mid 1970s. Starting from a steel production level of below 2 million tons in 1975, the Korean industry produced 10.8 million tons in 1981. The tremendous increase in production stems from the exceptionally fast construction of a 8.5 million tons integrated steel works built by Pohang Iron and Steel Company. This new steel works took about 10 years to construct with the last 6 million tons capacity being built in only 4 1/2 years. The rapid construction of the Pohang works and its incorporation of the latest technology and low labour cost makes it possibly the world's lowest cost integrated steel producer.

The Republic of Korea's steel industry underwent the most dramatic growth in the world during the 1970s. As a result of the completion of the first stage of development of the Pohang Steel Works, the total crude steel integrated output steel capacity of the iron and steel industry in the country as a whole increased from 911,000 tons in 1971 to 2,183,000 tons in 1973. Since then, Pohang Steel Works has carried out phase two and three capacity expansion projects in 1976 and 1978 respectively and the said capacity was raised to 456,000 tons in 1976, and 524,000 tons in 1978. As of 1980 the capacity rose to 9,335,000 tons crude steel ingot per annum which corresponds to an average increase rate of 32.5 per cent per annum during 1973-1980. Such a marked increase in capacity has contributed not only to a stable supply of iron and steel but a very high scale of economy of heavy industrialization. This remarkable growth achieved in the iron and steel industry in the Republic of Korea since 1970 made the industry self-sufficient in iron and steel products. The Republic of Korea now appeared as a promising strong iron and steel making country in the world. The iron and steel industry in the Republic of Korea consists of Pohang Integrated Iron and Steel Company,

16 steelmaking enterprises based on electric furnaces and 61 enterprises. In this context, capacities are pig iron making 8,019 tons, steelmaking per annum 12,335 tons and rolling 12,949 tons. The crude steel production and apparent steel consumption of the Republic of Korea during the period 1972-1983 are given in table 26.

Table 26. Crude steel production and apparent steel consumption, Republic of Korea, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	586	1,496	54
1973	1,157	2,860	84
1974	1,947	3,256	93
1975	1,994	2,964	84
1976	3,511	3,932	110
1977	4,346	5,437	182
1978	4,969	6,640	180
1979	7,610	6,885	183
1980	8,558	6,100	160
1981	10,753	7,480	193
1982	11,758	7,620	194
1983	11,915	8,890	223

Source: International Iron and Steel Institute, 1984.

While the apparent steel consumption recorded an average annual growth rate of 6.7 per cent during 1976-1981 and 19.6 per cent during 1972-1981, the growth rates in steel production were still faster at about 25.1 per cent in the period 1976-1981 and 38.2 per cent during 1972-1981. The per capita steel consumption substantially increased from 54 kg in 1972 to 218 kg in 1981.

The Republic of Korea has high productivity and low labour cost. These factors have allowed the country's steel makers to expand agressively into export markets. It is expected that the Republic of Korea will increase its export of steel from 5.2 million tons in 1981 to 14.4 million tons in 1990. The forecast of demand for iron and steel in the Republic of Korea has been conducted by the various institutions based on both micro and macro methodological approaches. As a result of a long term forecast for iron and steel requirements conducted on the assumption that the iron and steel demand

pattern in the Republic of Korea would be similar to the world pattern, it was identified that the iron and steel requirement in the Republic of Korea is estimated at 16.04 million tons in 1986 and 25.08 million tons in 1991 respectively and such forecasts are very close to the projections already conducted by the Republic of Korea Development Institute.

The country has ambitious expansion plans for the steel industry and the annual capacity is anticipated to approach the levels of 14 million tons/year by 1985 and 24 million tons/year by 1990 compared to the present capacity of about 12 million tons/year.

3.3.9 Pakistan

Pakistan presently has only two steel plants. The largest plant with 1.1 million tons per year is the Pakistan Steel Mills new Bin Quasim Works in Karachi. By 1986, it is proposed to raise the capacity of this plant to 2 million tons per year. The apparent steel consumption during 1972-1983 is shown below:

Table 27. Crude steel production and apparent steel consumption, Pakistan, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	...	382	6
1973	...	367	5
1974	...	435	6
1975	...	537	7
1976	...	497	7
1977	...	700	9
1978	...	600	8
1979	...	800	9
1980	...	640	8
1981	20	695	8
1982	20	580	7
1983	500	680	6

Source: International Iron and Steel Institute, 1984.

The apparent steel consumption registered an average annual growth rate of 10.0 per cent during 1976-1981 and 8.6 per cent during 1972-1981.

3.3.10 The Philippines

The iron and steel industry in the Philippines started in 1948, when the National Development Company established the first nail making plant. The 1950s was a decade of several firsts of the industry. In 1951, the first three rolling mills were installed by Philippine Blooming Mill, Sta Ana Mills and the Central Steel Manufacturing Company. These mills cut scrap bars into billets which were reheated and rolled into reinforced bars. In 1952, the first scrap melting plant was established by the Marcelo Steel Corporation. In 1956, the first sheet galvanizing plant was established by Elizalde Steel Corporation. Pipe and tube making was pioneered by Republic Steel Tubes (INC) in 1958. By the end of the 1950s, there were a number of firms producing a variety of steel products ranging from GI sheet to pipes and tubes.

In the 1960s, steel production grew by an average annual rate of 30 per cent in real terms. However, even though production growth outpaced the growth in steel demand, steel production never met the actual requirements. The gap between production and demand had to be filled with imports. At the beginning of the 1960s at least 50 per cent of the steel requirement was met with imports. The proportion decreased very gradually until it was 40 per cent at the end of the 1960s. The 1970s brought many changes to the iron and steel industry as a result of external and internal developments. On the average, steel production showed a negative 3.8 per cent real growth between 1970-1972, 1973 and 1974 were better years because the newly founded Iron and Steel Authority stimulated and regulated the industry through its co-operative raw material purchasing programme and through its enforcement of stronger tariff protection laws. In 1975, the government-led construction boom caused steel demand to increase by 19.2 per cent in real terms. Domestic production increased by 28.5 per cent from its 1974 level, reaching a high of 659,000 metric tons. In 1976, steel production growth was a relatively low 4.7 per cent and for the rest of the decade, steel production growth averaged around 4.9 per cent keeping just a pace ahead of the 4.3 per cent average consumption growth rate.

The production and consumption of steel during 1972-1983 is shown in table 28.

Table 28. Crude steel production and apparent steel consumption, Philippines, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	173	1,350	35
1973	216	1,206	30
1974	233	1,214	29
1975	309	1,088	26
1976	350	1,394	32
1977	357	1,640	36
1978	276	1,526	33
1979	397	1,827	39
1980	330	1,500	31
1981	350	1,375	28
1982	350	1,900	37
1983	200	1,630	31

Source: International Iron and Steel Institute 1984

The apparent consumption of steel registered an average annual growth rate of 1.5 per cent during 1976-1981 and 1.2 per cent during 1972-1981. The iron and steel industry has also been growing in importance as a foreign exchange earner with export of its products increasing significantly in the past decade at an average of 110 per cent annually. In 1980 some US$ 144.1 million worth of iron and steel products were exported. Despite the rapid increase in its export shipments, however, the industry remained import dependent. Iron and steel imports were worth US$ 209 million in 1980. The national capacity stands at about 400,000 tons per year. One of the developments that iron and steel producers are optimistic about is the establishment of the direct reduction plant in the integrated steel mill.

The demand for iron and steel products is expected to increase as the Government expands its infrastructure and housing programmes. The demand projections of iron and steel products based on the estimated growth of consuming industries with 1979 as the base year up to 1990 are given in table 29. It is expected that the demand for steel goods will reach 3,250,000 metric tons by 1990 reflecting an average growth rate of 7.9 per cent. Flat products are expected to grow by 7.5 per cent annually and non-flat products by 8 per cent.

Table 29. Projected demand for iron and steel products[a/], Philippines, 1970-1990
(Thousand metric tons)

Products	Base year 1979	1980	1981	1982	1983	1984	1985	1990	Growth rate (Percentage)
A. Flat products									
Cold-rolled steel									
Tinplates	166	172	179	186	194	202	210	255	4.0
G.I. sheets	145	158	173	190	208	228	249	392	9.5
Cold-rolled sheets	67	72	78	84	91	98	106	144	8.0
Subtotal	378	402	430	460	493	528	585	791	6.5
Hot-rolled steel									
Plates	115	127	141	156	173	192	213	358	10.9
Hot-rolled sheets	60	66	73	80	88	97	107	189	10.1
Pipes and tubes	104	111	119	127	136	145	155	217	6.9
Subtotal	279	304	333	363	397	434	475	764	9.3
Total flat products	657	706	763	823	890	962	1,040	1,555	7.5
B. Non-flat products									
Steel bars	528	569	615	665	718	775	837	1,329	8.0
Wire rods	125	136	149	162	176	191	203	308	8.7
Structural shapes, sections and rails	26	28	30	32	35	38	40	58	7.6
Subtotal	679	733	794	859	929	1,004	1,080	1,695	8.0
Total finished steel	1,336	1,439	1,557	1,682	1,819	1,966	2,120	3,250	7.9
Crude steel equivalent	b/1,712	1,845	1,996	2,156	2,332	2,521	2,718	4,167	

a/ Based on the estimated growth of consuming industries for a 10-year period.

b/ Based on Yield Factor 0.78.

Source: MIRDC Primary Iron and Steel Industry in the Philippines, 1980.

A 1.25 million tons per year plant is being established at Philippines' National Steel Co., Mindanao. This is based on the DR process of steelmaking. The Philippines' first galvanizing plant, Philippines Steel Coating Corporation will produce 50,000 tons per year of galvanizing coil. NKK, Japan have a project to build a 130,000 tons per year heavy plate mill to be fed by electric steelmaking and continuous casting. According to a World Bank study the prospects for economic basic steel production in the Philippines would be appreciably influenced by how well the following business conditions are satisfied:

(a) The existing world excess of steel supply over steel demand will be diminished significantly by the mid 1980s.

(b) The availability of semi-finished products, billets, blooms, slabs for rerolling will become less certain and supply of such items will be subject to increased price volatility.

(c) Prices of semi-finished and finished steel products will strengthen relative to prices of major inputs by the mid 1980s.

(d) Relative prices of steel plant capital equipment are likely to rise.

3.3.11 Singapore

The Singapore economy achieved a growth rate of 6.3 per cent in GDP during 1982 compared to a growth rate of 9.7 per cent in 1981. The country witnessed a high industrial growth resulting in a substantial rise in steel consumption in the last decade. The crude steel production and apparent steel consumption during the period 1972-1983 are given in table 30.

The apparent steel consumption registered an average annual growth rate of 12.1 per cent during 1976-1981 and 11.2 per cent during 1972-1981.

Table 30. Crude steel production and apparent steel consumption, Singapore, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	198	912	424
1973	211	1,229	561
1974	194	1,762	790
1975	196	1,527	716
1976	203	1,242	586
1977	215	1,014	435
1978	281	1,235	526
1979	293	1,610	676
1980	340	1,888	788
1981	263	2,215	975
1982	359	1,920	...
1983	305	2,125	...

Source: International Iron and Steel Institute 1984.

The steel industry spent about US$ 26 million on capital investment in 1982 and is expected to spend another US$ 49 million in the calendar year 1983. The investments are basically for uprating of melting facilities to bring billet production to 500,000 tons per year from the current 350,000 tons per year and for the installation of a new rolling facility to replace an older less-efficient facility and to bring rolling capacity to about 600,000 tons per year. Uprating of melting facility is underway and these facilities are likely to be completed in 1983/1984.

3.3.12 Thailand

Prior to the year 1966, almost all the domestic demand for iron and steel in Thailand was met by imports. The rapid growth in the domestic demand gave rise to the setting up of a number of iron and steel units in Thailand. Steel production started in the year 1960 when galvanized sheets and steel plants were produced by Thailand Iron Works Limited.

In 1963, a joint venture enterprise between Japan and Thailand, the Steel Pipe Company Ltd., was established and started its production of welded steel pipes in 1965. During the 1960s, a substantial number of rerolling mills and sheet steel finished plants were set up as a result of a boom in the construction sector in Thailand. In 1966 bar production was started using electric arc furnaces. During the 1970s, there was an upward trend in the production of iron and steel. Total production rose from 653,000 tons in 1974 to 1,116,000 tons in 1979. The share ot bars in total production in 1979 was almost 60 per cent of the total production. The percentage share of galvanized sheets, welded pipes, tin plates and light gauges were 11.4 per cent, 22 per cent, 5.7 per cent and 2.3 per cent respectively. Thus bars and wire rods constituted about 60 per cent while flat steel products represented about 40 per cent of the total domestic production. With the rapid progress in industrialization in Thailand domestic demand for iron and steel has increased considerably in the 1970s. In 1966, total steel consumption was estimated to be around 610,761 tons. It rose to 1,070,000 tons in 1970 and stood at 2,100,000 tons in 1977. The average annual growth rate was 11 per cent for the year 1970-1979 compared to 7.2 per cent for the average annual growth rate of the economy in the same period. Amongst flat and non-flat products the average annual growth rate for flat products was 15.4 per cent as against 8.1 per cent for non-flat products during the period 1970-1979. Flat products are perhaps the least developed sector of the steel industry in Thailand. The reason why all the flat products have to be imported is that the domestic demand is not large enough to enable producers to set up sheet rolling mills profitably. It seems that the country will have to continue to rely on imported flat products in the forseeable future as domestic demand is unlikely to increase to a level that will warrant the high investment necessary to establish the rolling mills.

Thailand achieved a modest economic growth rate of 5.7 per cent during 1981. The indigenous steel production has been quite insufficient to meet the growing steel demand. The crude steel production and apparent steel consumption during the period 1972-1983 are shown in table 31.

Table 31. Crude steel production and apparent steel consumption, Thailand, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	283	1,081	28
1973	324	1,240	31
1974	326	1,183	29
1975	251	983	26
1976	281	1,424	32
1977	309	1,675	36
1978	346	1,902	33
1979	440	2,144	39
1980	450	1,975	31
1981	300	1,839	28
1982	350	1,580	37
1983	350	1,960	31

Source: International Iron and Steel Institute, 1984.

The apparent steel consumption recorded an average annual growth rate of 8.8 per cent during 1976-1981 and 7.7 per cent during 1972-1981.

The steel industry in Thailand is comprised of 6 steel plants with a combined capacity of 728,000 tons per year. A feasibility study for a 2.1 million tons per year DR based integrated steel plant is being done by ESTEL Technical Services, Netherlands. This proposed plant would have a raw steel making capacity of 1.6 million tons per year with 600,000 tons per year of hot rolled products and 740,000 tons per year of cold rolled products. The recent discovery of natural gas in the Gulf of Thailand has focussed the attention of the Thai Government on the possibility to establish a sponge iron and an integrated steel industry in Thailand. However, the DR process is preferred to the BF process due to the low investment costs and also the domestic demand is only large enough to justify setting up of direct reduction plants. In view of the low quality of local iron ore and the difficulty of transporting it to the plants the ore could be imported from Australia or India.

3.3.13 The area of Hong Kong

The area of Hong Kong has a total steel consumption (annual basis) of 1.4 to 1.5 million tons. The crude steel production for the area of Hong Kong for the period 1972-1983 is given below:

Table 32. Crude steel production and apparent steel consumption, the area of Hong Kong, 1972-1983

Year	Crude steel production 1,000 tons	Apparent consumption in terms of crude steel 1,000 tons	Per capita consumption kg
1972	110	...	...
1973	115	...	...
1974	120	784	184
1975	120	725	166
1976	120	1,155	264
1977	120	1,451	262
1978	120	1,875	408
1979	120	1,860	381
1980	120	2,000	416
1981	120	2,200	427
1982	120	2,330	445
1983	120	2,090	394

Source: International Iron and Steel Institute, 1984.

The import of iron and steel products by the area of Hong Kong were US$ 76,592,000; US$ 143,896,000 and US$ 680,107,000 during the period 1970, 1975 and 1980 respectively. The details of steel imports for 1975, 1980, 1981, 1982 and 1983 are given in table 33.

Table 33. Imports of steel products and raw materials, the area of Hong Kong, 1975-1983

Imports	1975	1980	1981	1982	1983
Steel products					
Ingots and semis	74	156	127	91	72
Railway track material	-	5	3	2	7
Heavy structurals	25	130	257	301	180
Wire rods	8	30	22	17	22
Concret reinforcing bars		-	-	839	920
Other bars and light shapes	168	784	749		
Plates	42	117	101	99	104
Strip	13	27	20	21	28
Galvanized sheet	19	47	48	53	63
Tinplate and blackplate	25	42	48	39	45
Other sheet and coil	65	175	196	149	215
Steel tubes and fittings	34	95	103	131	115
Drawn wire	27	37	36	33	40
Other steel products	-	1	2	5	3
Total	500	1,645	1,710	1,825	1,821
Raw Materials					
Iron ore	...	...	...	...	...
Pig iron	18	19	23	12	...
Ferro-alloys	1	2	4	6	3
Scrap	49	93	94	64	27

Source: IISI Steel statistics of developing countries, 1985.

3.3.14 Nepal

Nepal has met all its requirements of iron and steel products through imports from India. The total imports for iron and steel products were US$ 1,392,000 and US$ 6,837,000 in 1975 and 1980 respectively. There is a plan to build a micro-mill. The plan for a 40,000 tons/year steel works is backed by Himal Iron and Steel Co. founded 20 years ago to import rebar. Himal is supported by the Nepalese Government in its effort to introduce steel making to the country.

3.3.15 Sri Lanka

Sri Lanka has also met the bulk of its iron and steel products requirement through imports. The imports of the iron and steel products were US$ 11,646,000, US$ 16,236,00 and US$ 70,766,000 during the period 1970, 1975 and 1980 respectively. Sri Lanka is establishing a nominal steel making capacity based on the DR:EAF route and it is expected that by 1986, 65,000 tons of steel shall be produced per annum.

4. PLANNING FOR FUTURE STEEL CAPACITY

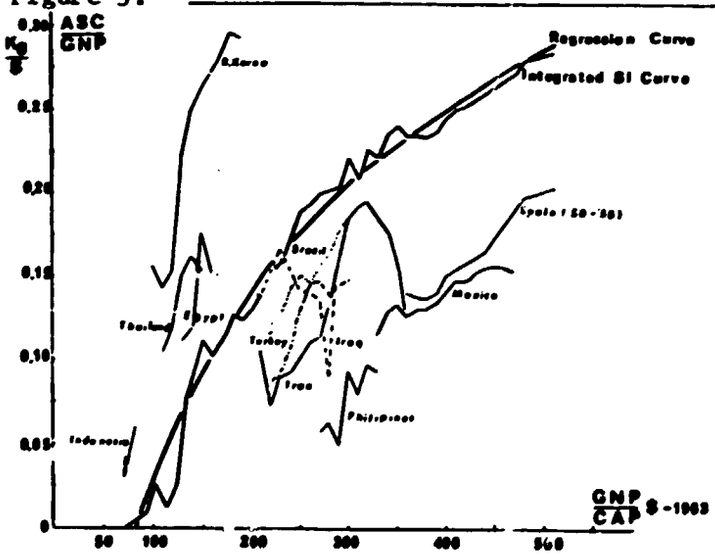
Planning for steel production should be well ahead of planning for the rest of the sectors. First, steel is a basic commodity and its use is all pervasive in the production of all other commodities. Second, the transport problems involved in assembling the raw materials required in bulk for the production of steel are big. Third, the stages through which iron ore has to pass before conversion first into ingot steel and then to finished steel are numerous and planning all along this line depends on the plan for steel production. Fourth, there is the problem of transport of finished steel to consuming centres. Fifth, the creation of production facilities for steel involve a long gestation period. The interval between the decision to set up a steel plant and the time when the unit actually goes into production and finished steel is ready for despatch to consumers, is appreciably long. Considerable work is involved in site clearance, civil construction, transport of heavy capital equipment, erection at site and in tackling the teething troubles normally met in the commissioning of a steel plant. The gestation period is longer in the developing countries which have inadequate facilities for the manufacture of heavy metallurgical equipment and insufficient technical skill for the erection and commissioning of the equipment. Yet another crucial factor which has a bearing on the gestation period is the scarcity of both internal finance and foreign exchange for the import of capital equipment. Investment in the steel industry is so large that it usually overshadows investment in other industries. Hence great care is called for to make investment decisions in the steel industry, especially when operating with limited domestic and foreign capital resources.

All these make it imperative for the developing countries first to project their future demand for steel on a long term basis and then think of the production facilities. Such long term projections for basic commodities like steel take into account the possible changes in the structure of the economy of the country. Also it helps to make the planning of steel production a continuous process, which is essential owing to the long time interval involved. Further, a knowledge of the magnitude of steel demand over

some years can help decisions on the planning of indigenous fabrication of metallurgical equipment and the complimentary facilities for intermediate products.

The concept of a steel intensity curve for the relationship between economic development and steel demand has been discussed. Now it is of interest in what stages of the estimated SI curve for the developing ESCAP countries are located. The theoretical SI curve estimated by IISI (figure 3) shows that in the Republic of Korea at US$ 100 per capita GNP, the apparent steel consumption per dollar of GNP shifts from .15 kg per dollar to .30 kg per dollar. At the same level of per capita GNP this ratio increases from .10 kg to .17 kg per dollar in case of Thailand. The per capita GNP of Indonesia has not reached US$ 100 and consequently the apparent steel consumption estimated per dollar of GNP is still at a low level of 0.05 kg per dollar. In the case of the Philippines, the ratio of steel consumption and GNP is still at 0.07 kg per dollar although the per capita GNP is as high as US$ 500.

Figure 3. STEEL INTENSITIES OF DEVELOPING COUNTRIES



Note: Given the relatively short income span covered by the curve, it has been possible to apply a different method to smooth the steel intensity curve. By means of correlation calculation a regression curve:

$$\frac{SI}{(kg/\$)} = 0.1585^{1} \log \frac{(GNP/cap.)}{(\$p.c.)} - 0.6991 \quad (r=0.9919)$$

has been found to give a good fit.

Source: Steel Intensity and GNP Structure, IISI, 1974

From the above observation, it can be stated that the demand for iron and steel products of the Republic of Korea has entered the stage of rapid growth while that of Indonesia, Thailand and the Philippines has not.

The close relationship between the process of economic development and the economic structure has been identified. Furthermore, the economic structure determines the demand structure of steel products in terms of product items. Therefore, the stages of economic development are expected to have an effect on product items of steel demand. The construction and consolidation of industrial plants, harbours, railroads and highways among other large scale investments often increase demand for non-flat steel products. On the other hand, the development of such industries as automobile, shipbuilding, other transportation machinery, industrial machinery and electric machinery brings about a large increase in the demand for flat iron and steel products.

The sectoral share of steel consumption of the Republic of Korea in 1979 was as follows:

Table 34. Steel consumption by sector, Republic of Korea, 1979 (percentage)

Sector	Percentage
Construction sector	52.1
Metal products industry	24
General machinery industry	9.6
Electric machinery industry	4.5
Automobile industry	5
Shipbuilding industry	4.0

Source: Institute of Developing Economies, Tokyo, 1982.

The steel product consumption share in the whole manufacturing sector was 47.9 per cent. For the share of the manufacturing sector in which the consumed quantity of flat steel products was greater than that of non-flats was 47.9 per cent and the share of flat product consumption in total steel

product consumption in 1979 was as large as 51.2 per cent. As the development of the machinery industry holds a strategic role it can be foreseen that the growth rate of the demand for flat iron and steel products in the country will accelerate in the future. In the case of the Philippines the steel consumption share by the construction sector was 43 per cent. The metal product industry's share was 28 per cent, automobile 8 per cent, shipbuilding 3 per cent, joint machinery 2 per cent and electric machinery industry 1 per cent. The share of flat iron and steel products in the total steel products consumption was as high as 49.1 per cent. In the case of Thailand the construction sector had a share of 60 per cent, the manufacturing sector 15 per cent and the remaining sectors consumed 25 per cent.

Singapore plays the role of a relay station. A large quantity of foreign steel materials is imported to Singapore and after receiving slight processing treatment it is re-exported to neighbouring countries. The Republic of Korea, Malaysia and India are the three countries which have blast furnaces for integrated iron and steel production. In Indonesia, the integrated iron and steel production is based on direct reduction furnaces. The Philippines, Thailand and Singapore have semi-integrated steel production facilities based on electric arc furnaces to produce crude steel from scrap. Malaysia is also installing facilities for production of DRI.

Aiming at self-sufficiency and import substitution of iron and steel products, most of the Asian countries have installed sufficient facilities for the production of wire rods, steel billets, welded pipes, wires, galvanized sheets and tinplates. With regard to heavy sections, hot rolled plates, sheets, cold rolled sheets, the Republic of Korea and India have production capacities large enough to meet the domestic consumption. In the Philippines and Thailand studies have been made on the possibility of introducing blast furnaces and the construction of a DRI plant for integrated iron and steel production.

The size of the market of iron and steel imports in Asia with the Republic of Korea, Taiwan Province of China, the area of Hong Kong and ASEAN countries included was 12.7 million metric tons in 1979. Of this, countries like the Republic of Korea, the area of Hong Kong and Singapore and Taiwan Province of China shared 60 per cent and the remaining ASEAN countries 40 per cent. The import of iron and steel products of these countries ranged from 1.08 million tons for Malaysia to 2,280 million tons for the Republic of Korea. The share of Japan in the total iron and steel import was the greatest and varied between 60 and 80 per cent for different categories of products.

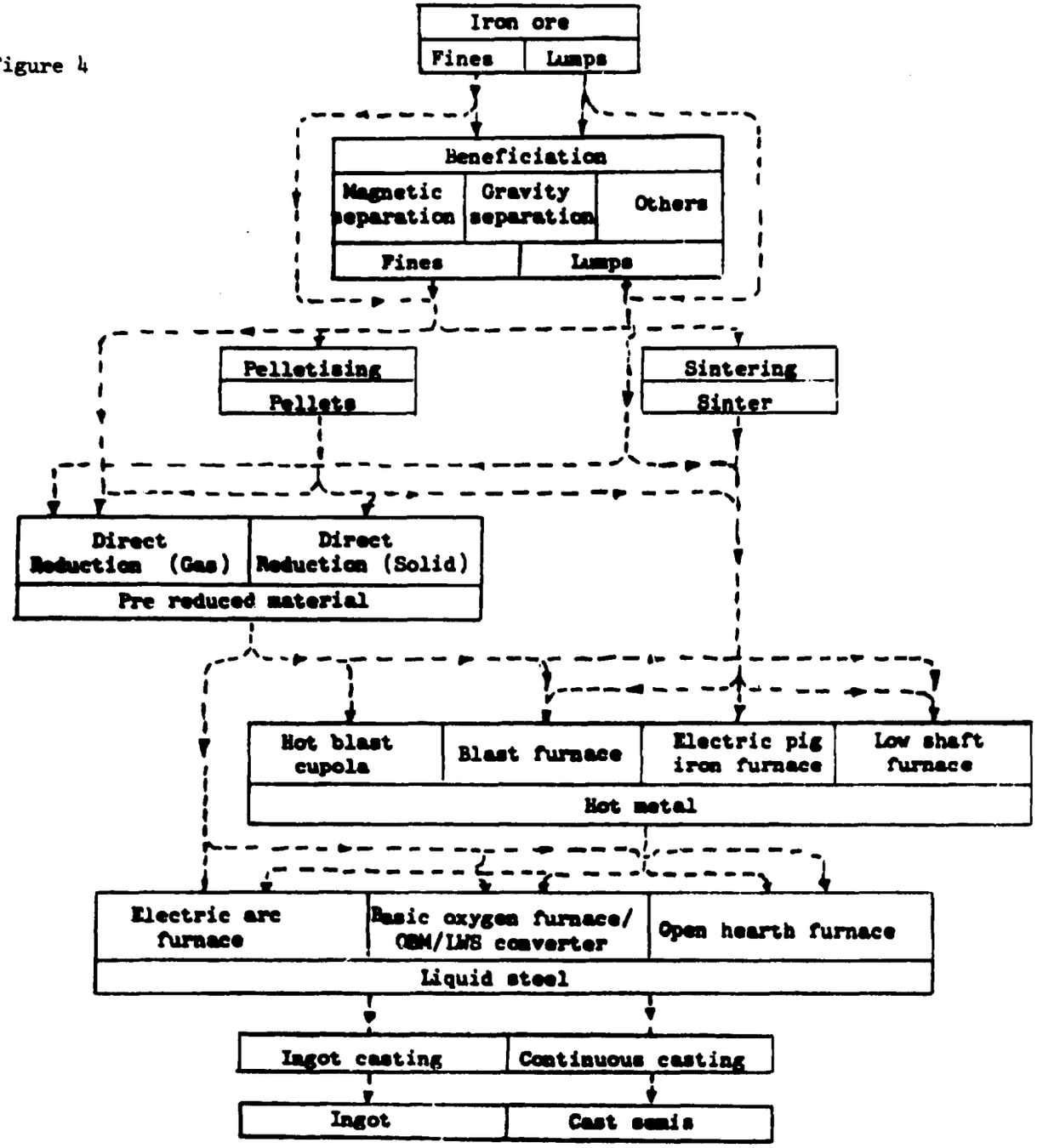
In 1979, the share of flat iron and steel products in total iron and steel imports was between 40 and 60 per cent for Thailand, Indonesia, Singapore and Malaysia, 30 per cent in the Philippines and 20 per cent in the Republic of Korea and the area of Hong Kong. Since the Republic of Korea and the Philippines have rolling facilities for the production of flat iron and steel products, ingots comprise more than 55 per cent of the iron and steel imports of these countries. For the area of Hong Kong the share of self production is as low as 8 per cent. In 1979, the domestic production of crude steel was 0.12 million tons compared to the net import of 1.3 million tons. The share of non-flat steel in total iron and steel import is large. Singapore is exporting pipes and other steel products for extractive work to Malaysia and Indonesia for use in the development of petroleum and natural gas in these countries. The Republic of Korea, the Philippines, Thailand and Singapore meet their requirement of hot coils from Japan.

In the South East Asian region in particular, the significant factor in the steel market is its small size in relation to the total area and population.

Regarding production several countries in the developing ESCAP region have established sizeable steel industries.

The demand in steel can be met by either recycling scrap or production of fresh metallic like pig iron/sponge iron and conversion of the same to steel. Iron ore is the basic raw material for production of such fresh metallic. The possible alternatives for production of steel are given in figure 4.

Figure 4


Iron ore
Fines
Lumps
Beneficiation
Magnetic separation
Gravity separation
Others
Fines
Lumps
Pelletising
Pellets
Sintering
Sinter
Direct Reduction (Gas)
Direct Reduction (Solid)
Pre reduced material
Hot blast cupola
Blast furnace
Electric pig iron furnace
Low shaft furnace
Hot metal
Electric arc furnace
Basic oxygen furnace/ OBM/LWS converter
Open hearth furnace
Liquid steel
Ingot casting
Continuous casting
Ingot
Cast semis

All these alternatives have been commercially exploited. The other important factors for production of pig iron/sponge iron is the choice of reductants. The options for various reductants are given in figure 5.

The choice of a particular alternative for a plant depends to a large extent on the capacity of the plant considered, which is directly dependent on the potential of the demand of a particular country. The availability of raw materials, reductants, energy, infrastructure, etc. are also major guiding factors for the choice of a process route. The possible alternative routes which can be considered for setting up of a mini steel plant are given below:

Alternative	Processing routes with major production facilities
A.	Electric arc furnace (EAF) based on steel scrap.
B.	Direct reduction unit - Electric arc furnace (DR-EAF)
C.	Electric pig iron furnace - Basic Oxygen converter (EPIF-BOF)
D.	Small Blast Furnace - Basic Oxygen Converter (SBF-BOF)

Downstream from steel making, the continuous casting route and conventional steel casting are the two alternatives available for casting of liquid steel. The continuous casting route is a cheaper proposition than the conventional steel casting route. Before a choice of technological process can be made, it would be essential to review the alternatives from the raw material and energy requirement considerations.

4.1 Raw materials

The basic raw materials required for the steel industry are the source of metallics and source of reductant. It is necessary to assess the potential of the region with respect to the availability of the raw material. The potential reserves of iron ore, coal and natural gas for the developing ESCAP countries are shown in table 35 and figure 6.

Figure 5

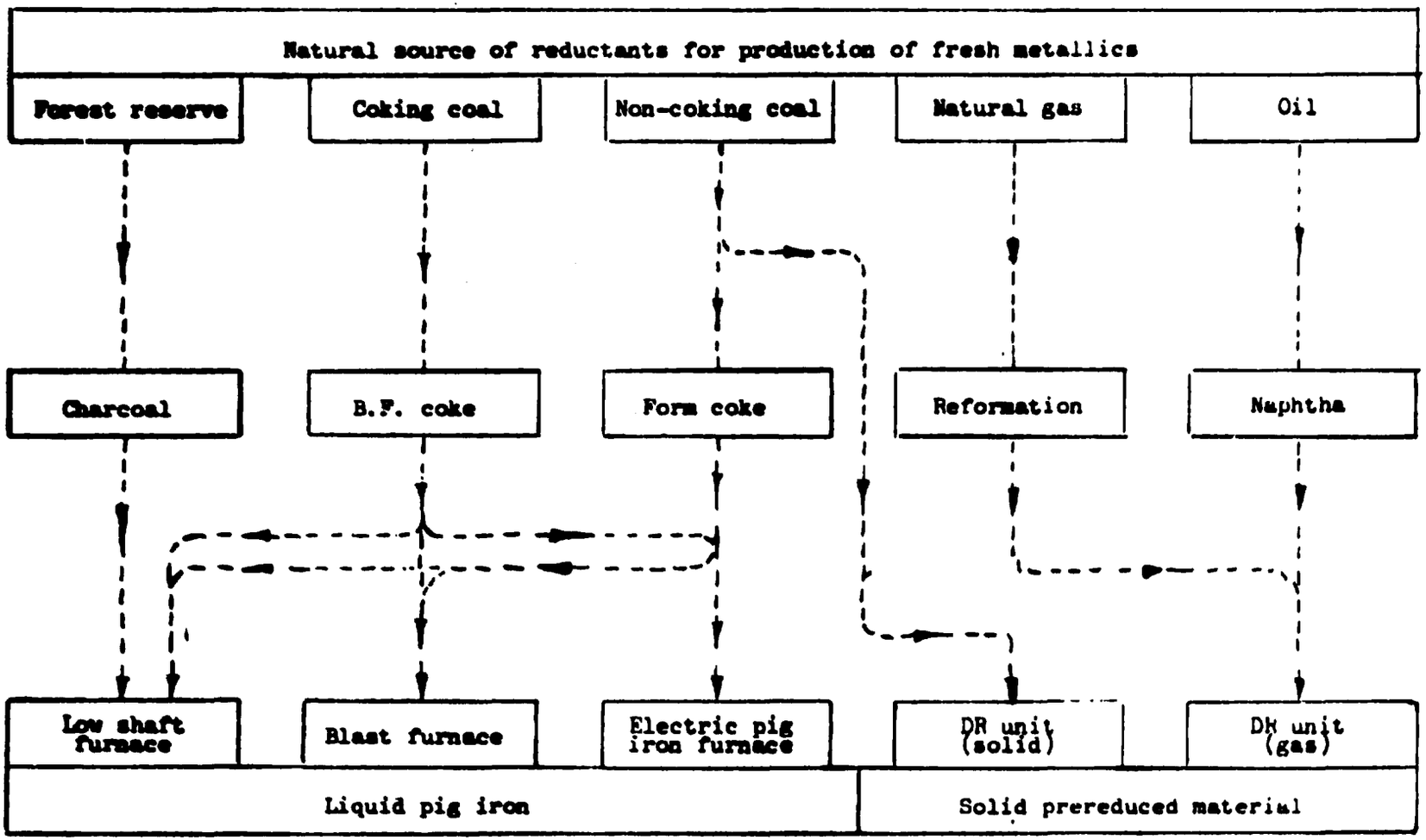
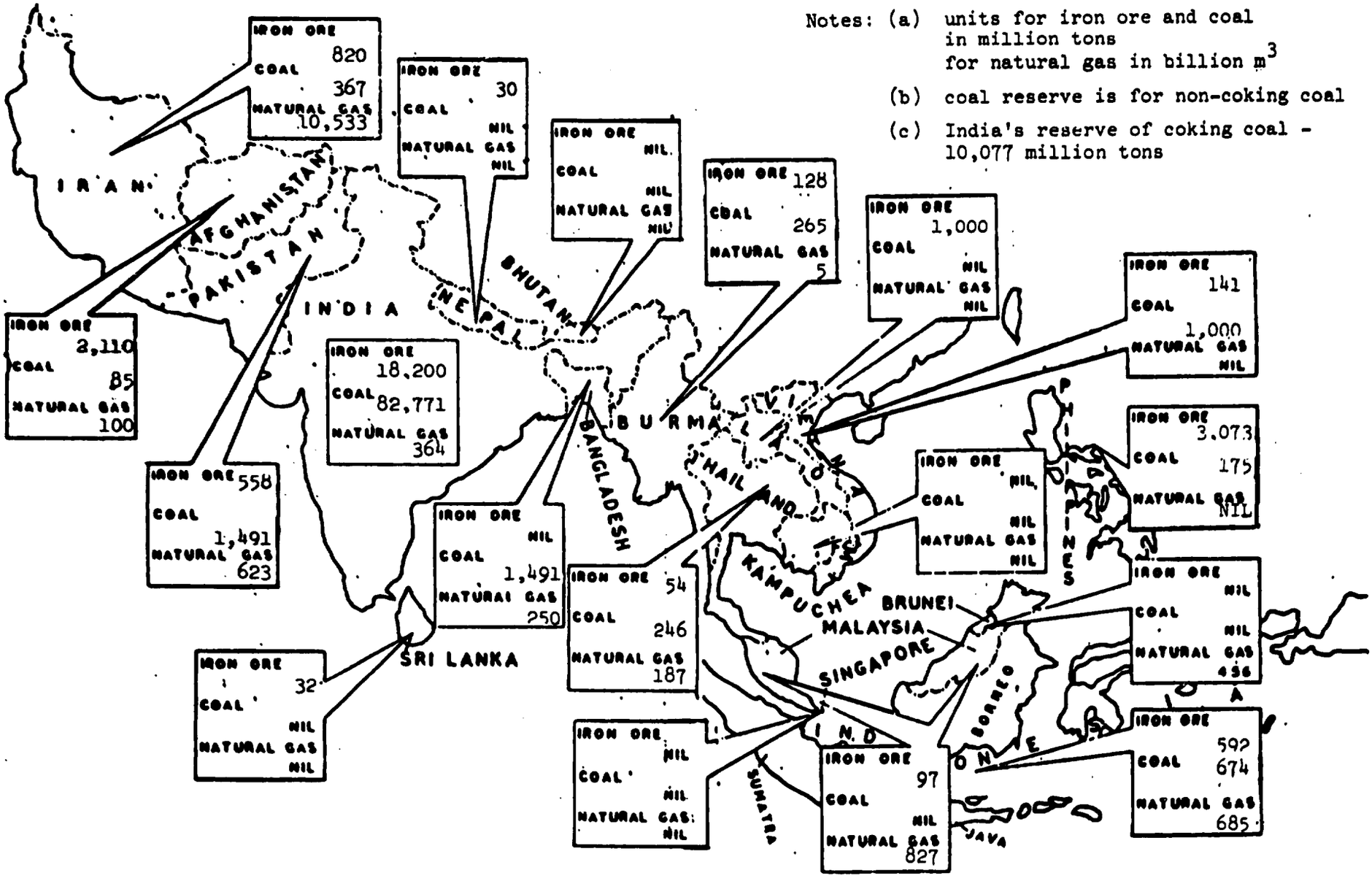

Natural source of reductants for production of fresh metallics
Forest reserve
Coking coal
Non-coking coal
Natural gas
Oil
Charcoal
B.F. coke
Form coke
Reformation
Naphtha
Low shaft furnace
Blast furnace
Electric pig iron furnace
DR unit (solid)
DR unit (gas)
Liquid pig iron
Solid prereduced material

Figure 6



Notes: (a) units for iron ore and coal in million tons
for natural gas in billion m^3

(b) coal reserve is for non-coking coal

(c) India's reserve of coking coal - 10,077 million tons

Table 35. Reserves of iron ore, coal, natural gas and crude petroleum in ESCAP countries

Country	Iron ore million tons	Coal reserves million tons	Natural gas 1,000 M^3	Crude petroleum million tons
Afghanistan	2,110	85	100	-
Bangladesh	-	1,491	250	-
Burma	198	265	5	10
Area of Hong Kong	6	-	-	-
India	18,200	82,771	344	354
Indonesia	592	674	685	1,070
Iran	820	367	10,533	6,148
Republic of Korea	74	182	-	-
Malaysia	97	-	827	143
Nepal	30	-	-	-
Pakistan	558	1,491	623	38
Philippines	3,073	175	-	12
Singapore	-	-	-	-
Sri Lanka	32	-	-	-
Thailand	54	246	187	-

Note: India's reserves of coking coal = 19,350 million tons
India's reserves of limestone = 63,151 million tons
India's reserves of Dolomite = 4,946 million tons

Source: MECON, India.

4.1.1 Iron ore reserves

Many of the developing ESCAP countries are favourably placed with regard to iron ore reserves. While these countries contribute only about 10 per cent to world raw steel production, their share of beneficiated iron ore production is more than 30 per cent and may go to 50 per cent by the year 2000.

Although, most of the developing ESCAP countries do have iron ore reserves, the reserves of the area of Hong Kong, Nepal, Sri Lanka and Thailand are low and are not considered commercially exploitable. India, Iran, Malaysia and the Philippines are the only iron ore producing countries in this region.

4.1.2 Scrap

Because of the absence of indigenous coking coal for the conventional route, scrap is a major input material to the steel industry even though its availability in the developing ESCAP countries is limited as per capita consumption of steel is very low.

4.2 Energy resources

4.2.1 Coal

Known economic recoverable reserves and potential of coal in anthracite, bituminous and semi-bituminous varieties in the ESCAP countries are given in table 36.

Table 36. Reserves of coal in developing ESCAP countries (Million tons)

Countries	Non-coking coal			Coking coal
	Total known	Economically recoverable	Potential	Potential reserve
Afghanistan	...	...	85	-
Bangladesh	780	591	1,491	-
Burma	...	...	265	-
India	82,771	...	82,771	10,077
Indonesia	573	...	674	...
Iran	367	...	367	...
Pakistan	804	172	1,491	-
Philippines	175	46	175	...
Thailand	246	118	246	-

Source: MECON, India.

In general, the entire reserves are for non-coking coal except for India and to a very limited extent for Iran and the Philippines.

Coal will pose a serious constraint in the steel development programmes of the developing ESCAP countries. It may be necessary to import coking coal from other countries to meet the demand. Non-coking coals have found so far limited applications in the iron and steel industry. To help off-set the dependence on coking coal, intensive efforts are being made to use non-coking coals in iron making and these are reflected in the use of formed coke, coal dust injection, washing and blending with coking coal and development of the direct reduction processes. Thus there is a good potential for greater use of non-coking coal in future in the iron and steel industry.

4.2.2 Natural gas

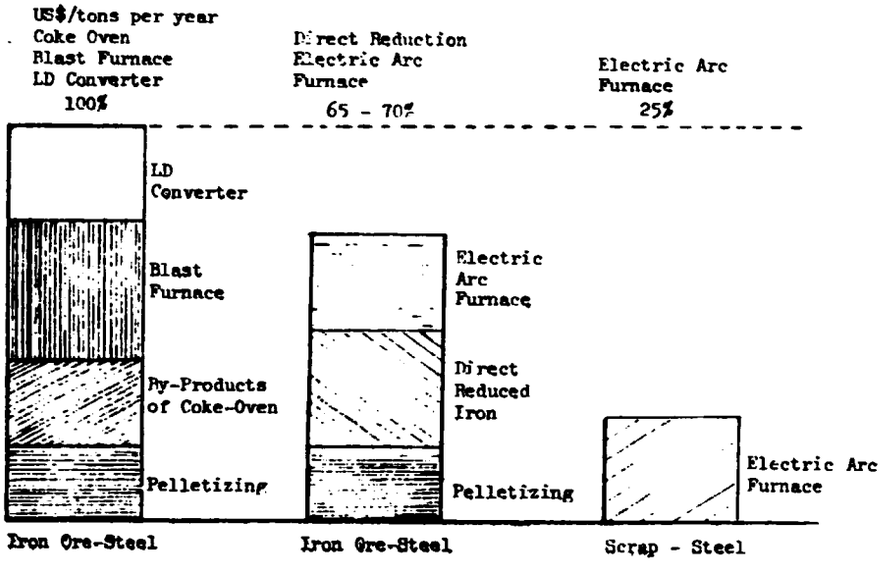
Bangladesh, Indonesia, Iran, Malaysia and Pakistan are quite favourably placed as regards the availability of natural gas. Exploitation of this natural gas could contribute to the growth of the iron and steel industry in the developing ESCAP countries.

4.3 Demand size and steelmaking methods

At present the steel making method by blast furnace and BOF is most commonly used in the world. The most efficient equipment set consists of blast furnaces of 4,000 to 5,000 m^3 size which give a production of 10,000 tons/day. The present iron and steel plant is equipped with 2 to 3 blast furnaces of this size and produces 6 to 10 million tons of crude steel per year. Therefore, the steel making method by blast furnace and BOF is suitable for the rapid growing economy, when the size and the growth rate of the demand for iron and steel products are large.

In general, while the iron and steel production by blast furnace is extremely capital intensive and requires large amounts of investment, the capital cost per unit of crude steel produced by electric arc furnaces is as low as 1/4 to 1/3 of the unit capital cost by the BF-BOF route. The capital cost by the DR-EAF route is 65 to 70 per cent of the conventional iron making route. (figure 7)

Figure 7. Capital investment cost by furnace



Source: Metal Bulletin's Mini Mill Conference, Milan, March 31 - April 1980 - 1980 Decade of Opportunity for Electric Steel Making - J.W. Brown/UCC.

The utilization of electric arc furnaces to produce iron and steel products from iron scrap is specially suitable to countries and regions where iron scrap can be supplied regularly at low prices and labour and electric power are available at low cost.

For these iron and steel plants with a demand scale less than 1.8 million metric tons per year, the scrap iron and electric arc furnace method of the DR and EAF method are better than the BF-BOF, even though the scrap for DR and EAF has to be imported, since size capability in mini-mills using the DR and EAF method can be matched to the exact market requirements, and, when necessary, modular expansion can be reserved for meeting the increase in demand.

The size of domestic demand for iron and steel products in developing ESCAP countries is in the range of 1.7 to 2.3 million tons. Thus for these countries the scrap iron and electric arc furnace method and the DR-EAF are most suitable. For countries with a larger steel demand like India and the Republic of Korea, the crude steel production by the conventional route involving blast furnace and L.D. processes are better from the point of view of construction cost per unit of steel produced. In this case electric arc furnaces either using steel scrap or a combination of sponge iron and scrap can be used as a complement to blast furnaces.

Based on these constraints the nominal steel making capacities for the developing ESCAP region are given in table 37.

Table 37. Nominal steelmaking capacity, 1983, 1986, 1990
(thousand tons)

Country	1983	1986	1990
Republic of Korea	13,720	13,720	17,320
	(12,580)	(13,250)	(16,760)
Philippines	640	640	1,840
	(430)	(430)	(1,510)
Indonesia	2,310	2,410	2,410
	(1,060)	(1,500)	(1,500)
Pakistan	1,700	1,700	1,700
	(430)	(840)	(840)
Area of Hong Kong	210	210	210
	(120)	(120)	(120)
Burma	35	35	50
Bangladesh	257	257	257
Sri Lanka	65	65	65
Nepal	...	...	...
Afghanistan	...	...	...
Iran	1,970	2,770	5,170
	(1,380)	(1,940)	(3,620)

Note: ( ) = Estimated actual production.

The details of the suggested process route are given in table 38.

Table 38. Suggested iron and steel making processes

Sl. No.	Country	Suggested process route
1.	India	Market - very large; iron ore and reductant - available in plenty; hydro-power potential-good; steel development through large integrated steel plant; iron production route blast furnace/direct reduction route.
2.	Republic of Korea	---
3.	Iran	Market - very large; iron ore available; reductant natural gas plenty; hydro-power potential - very good; possible iron production route direct reduction/BF with imported coking coal; steel development - normally through large integrated plant.
4.	Afghanistan	Market - very limited; reductant - not sufficient; hydro-power potential - good; production of hot metal/sponge iron not planned; steel through EAF on scrap/purchased sponge iron.
5.	Bangladesh	Market - limited; reductant enough natural gas, hydro-power potential - exists; production of sponge iron planned; steel through EAF on sponge iron feed.
6.	Burma	Market - limited; iron ore - available; reductants - non-coking coal and forest reserve; hydro-power potential - very good; possible iron production route - small capacity blast furnace/direct reduction; steel through converter/EAF; integrated mini-steel plant.
7.	Indonesia	Market - large; iron ore available; reductant natural gas plenty; non-coking coal available; possible iron-making route direct reduction by 1985 and BF by 2000 AD with enlarged market; steel through integrated mini steel plant at initial stage possible.
8.	Malaysia	Market - fairly large by 2000 AD; iron ore - available; reductants - natural gas plenty and forest reserve; hydro-power potential good; possible iron production route - direct reduction initially, blast furnace when market enlarges; steel through integrated mini steel plant to start with.
9.	Nepal	Market - limited; no natural resources except small quantity iron ore; steel - through EAF on scrap/purchased sponge iron to start with; iron ore may be utilized later for not metal production and steel through integrated mini steel plant.
10.	Pakistan	Market - fairly large by 2000 AD; iron ore - available; reductant - natural gas/non-coking coal; iron making route - blast furnace/direct reduction; steel - through integrated plants based on hot metal/pre-reduced material; mini steel plant possible.
11.	Philippines	Market - large; iron ore - fairly large; reductant - non-coking coal/forest reserve; hydro-power potential - very good; steel development - normally through large integrated steel plant, mini steel plant possible through DR-EAF route.
12.	Singapore	Market - fairly large; no natural resources; possibility of steel development through large integrated plants based on purchased raw materials - planned after 1985.
13.	Sri Lanka	Market - limited; natural resources - non-except small quantity iron ore; hydro-power potential good; steel through EAF on scrap/purchased sponge iron.
14.	Thailand	Market - large; iron ore small quantity; reductant - non-coking coal; hydro-power potential - good; steel development possible through integrated mini steel plant or large capacity one on hot metal route, future possibility mini steel plants on direct reduction route.

4.4 Investment needs and sources of finance

Aiming at industrialization developing ESCAP countries are adopting policies to promote domestic supply and import substitution of steel products under the leadership of their Governments. The Governments in these countries made the master plans for the iron and steel industry, partipated directly or indirectly in the feasibility study of the steel factories, induced low interest foreign and domestic capital, established government enterprises, or financed private enterprises, constructed and consolidated such social infrastructure like harbours, roads, railways, electric and water power plants, lowered import duties of the necessary machinery and materials and have taken various other measures for the promotion of their domestic iron and steel industries.

In many cases even after a steel factory entered the period of operation, the Government continues its support for a certain period by providing long term low interest credit for working capital, discounts of public service fees, reduction or exemption of corporation tax, subsidies for industrial research or technical training and various export promotion policies.

The Pohang Iron and Steel Company of the Republic of Korea, the National Steel Corporation of the Philippines and Karatatu Steel Corporation of Indonesia are government enterprises while National Iron and Steel Mill Limited, Singapore and Malaywata Steel of Malaysia are private owned enterprises but financed by the Government. The Siam Iron and Steel Industry of Thailand is purely private. The National Steel Corporation of the Philippines first started in the 1950s as a private enterprise but in 1974 the ownership was transferred to the Government.

From the above, it is clear that government owned or government financed steel plants will continue to be dominant in newly constructed steel plants or plans to enlarge the existing steel plants in the future. The second integrated iron and steel plant in the Republic of Korea, the planned expansion of Karatatu Steel Corporation of Indonesia are materialized by using government expenditure. The enterprises are or will be under the management of the Government. The two direct reduced iron and steel plants being planned

for Malaysia will also be financed by the state Government. The plans to establish an ingot steel production plant in the Philippines and in Thailand still face some difficulties. However, the Governments of these countries plan to establish these plants under their leadership.

The construction of iron and steel plants requires large amounts of expenditure in terms of both money and time. The high cost of construction through the conventional iron and steel making route makes the construction of ingot iron and steel plants in the developing countries more and more difficult. Public attention is now directed towards the construction of DR plants and electric arc furnaces which require comparatively less capital. In the Philippines, the feasibility study for an integrated steel plant equipped with a blast furnace was finished in 1977, yet the construction work has not started because of insufficient funds. Recently there is a move towards changing its plan into construction of a low cost direct reduced iron plant. In those countries where natural gas can be extracted like Malaysia and Indonesia, the prevailing view is to utilize natural gas reduction of iron ore.

The Krakatau Steel Corporation in Indonesia is already equipped with direct reduction iron facilities with a production capacity of 2 million tons of reduced iron per year. This factory is presently producing .5 million tons of crude steel per year for both domestic consumption and export to neighbouring countries.

In Malaysia, the ongoing plans to establish two direct reduced iron plants now enter the stage of construction work.

Thailand has planned a direct reduced iron plant using the natural gas resources at Siam Gulf. The Government of Thailand has finished a pre-feasibility study for a 1979-2000 iron and steel master plan and has completed a pre-feasibility study for the production of flat iron and steel products by integrated steel plants equipped with blast furnaces. However, the construction has not yet started. Singapore has one integrated steel plant equipped with electric arc furnaces. For the time being, there are no plans to construct an integrated iron and steel plant based on blast furnaces or DR route in Singapore.

As the scales of investments and production related to the iron and steel industry are large, the industry usually has a relatively strong monopolistic character. The iron and steel industry is also related to other industries by its provision of iron and steel products for use as raw materials. Therefore, the development and competitiveness in the world market of those industries which use iron and steel products as inputs largely depend on price and supply conditions of these products.

The production of iron and steel products can be hardly adjusted in the short run while their demand is largely affected by general market fluctuations. Therefore, the prices of iron and steel products suffer from large fluctuations.

As a common measure to protect both producers and consumers, the developing countries often set ceiling prices to iron and steel products. In the Republic of Korea, iron and steel products are considered monopolistic commodities where ceiling prices are fixed by the Government which reflect actual production costs, marketing costs, reasonable profits and the prevailing demand and supply situation. Ceiling prices are also given to iron and steel products in Thailand.

In order to increase the effective protection rates of imports being substituted, ASEAN countries apply different duty rates to different products according to their degree of processing. In the case where an import licence system is applied to restrict imports, in some countries a collective import system is used for iron and steel products to secure domestic supply and to protect domestic users. The Government managed Krakatau Steel Corporation in Indonesia is importing steel items authorized by the Indonesia Government under a collective import system. In India, the Steel Authority of India Limited (SAIL) is the canalizing agency for import of steel products. In the Philippines, nominal import duties on imports are low, viz. 10 per cent on scrap, billets, slabs and HR coil. CR coil have, however, a 30 per cent duty. Tin plates and galvanized sheets are subject to 50 per cent duty. In the Republic of Korea, most of the iron and steel items are subject to import restrictions. Import duty rates are fixed in proportion to the degree of

processing. In Thailand, although the import duty rate of HR coil is as low as one per cent, the import duty rate of welded pipes and tubes processed from hot coils is as high as 30 per cent.

The developing ESCAP countries can substantially reduce the production cost of iron and steel plants if the following three support measures are provided:

(a) Provision of low interest long term credit for working capital;

(b) Exemption from income tax and reduction of import duties on raw material and machinery;

(c) Discount on public utility fees.

For the purpose of promoting and protecting the iron and steel industry, the Government might consider the following approaches:

(a) Put duties on import of iron and steel production;

(b) Limit import of iron and steel products;

(c) Apply export quota to secure domestic supply of iron and steel products.

In summary the developing ESCAP countries are a growth area with significant national resources and relatively low labour costs. Throughout most of the region lack of finance and industrial skills coupled with the social needs of the large majority of the population pose continuing difficulties. However, the steel industry development pattern already in progress suits the social and industrial needs of the region. Demand will outstrip the production capability in the region but both demand and production will grow at rates well above those of the industrialized regions.

The regional endowment of raw material is adequate and there is a desire to develop a steel industry. This will provide impetus to the growth rates of GNP and steel demand will be relatively high. Furthermore the opportunity exists to adopt modern practices and combine them with relatively low labour costs. Most of the raw material and scrap would be imported although local natural gas would be used for direct reduction of ore/pellets in Indonesia, Thailand and Malaysia and steel melting would be by EAF based on DRI supplemented by imported scrap. Singapore would continue with imported scrap or sponge iron EAF practice and in the Philippines the major production would come from conventional BF/BOF route. The Republic of Korea can be expected to continue its successful use of conventional BF/BOF practice backed up by private industry EAF development.

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