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UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

ECONOMIC AND SOCIAL COMMISSION
FOR WESTERN ASIA

THE IRON AND STEEL INDUSTRY IN THE ESCWA REGION

UNIDO

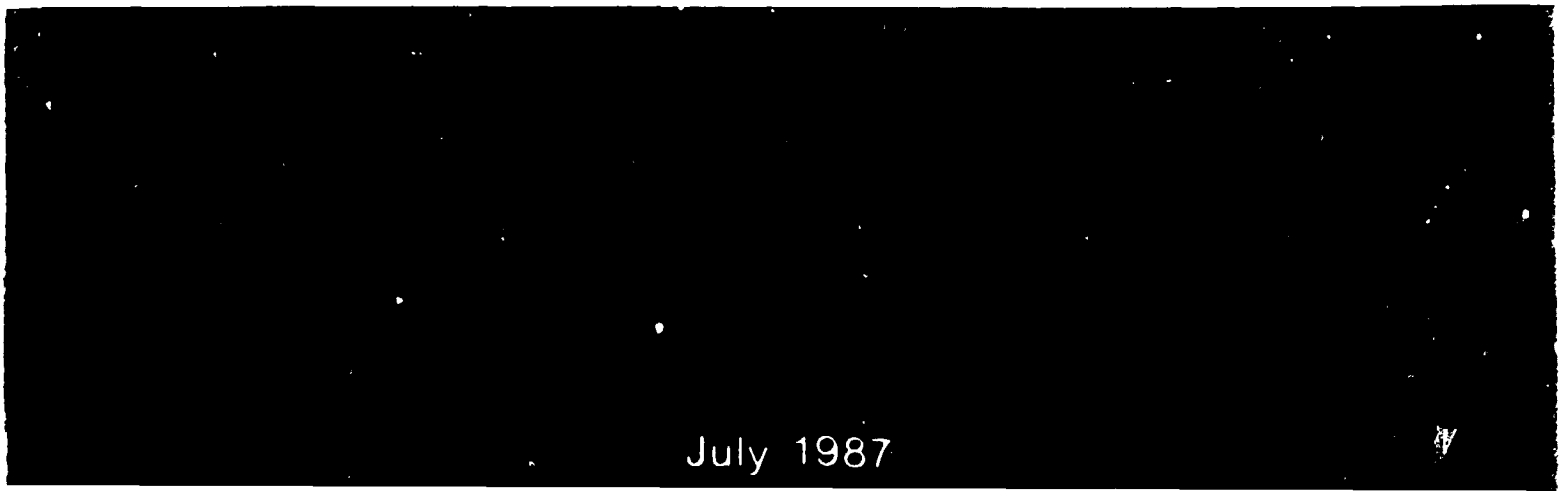
Sectoral Studies Series
No. 29

ESCWA
Development of
Selected Industrial Branches
No. 5

Prepared jointly by:

SECTORAL STUDIES BRANCH
STUDIES AND RESEARCH DIVISION

JOINT
ESCWA/UNIDO INDUSTRY DIVISION



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PREFACE

This paper presents the results of a study on the iron and steel industry in the Western Asia region jointly carried out by the Joint ESCWA/UNIDO Industry Division and the Sectoral Studies Branch, Studies and Research Division of UNIDO.

The paper gives a review and analysis of past development, present situation, basic problems and future trends and prospects for the development of the iron and steel industry in the following countries of Western Asia - Arab Gulf States, Syria, Jordan, Lebanon, Egypt, Yemen Arab Republic and the People's Democratic Republic of Yemen.

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ABBREVIATIONS

AFESD	Arab Fund for Economic and Social Development.
AISMI	Arab Iron and Steel and Metallurgical Institute.
AISU	Arab Iron and Steel Union.
AIIC	Arab Industrial Investment Company.
AIC	Arab Investment Company.
AIDO	Arab Industrial Development Organization.
APICORP	Arab Petroleum Investment Corporation.
CMRDI	Central Metallurgical Research and Development Institute.
ECE	Economic Commission for Europe.
EEC	European Economic Community.
ESCWA	Economic and Social Commission for Western Asia
GCC	Gulf Co-operation Council.
GOIC	Gulf Organization for Industrial Consulting.
IBRD	International Bank for Reconstruction and Development.
IISI	Iron International Steel Institute.
IDTC	Industrial Development Technical Centre (Qatar).
OAPEC	Organization of Arab Petroleum Exporting Countries.
SABIC	Saudi Basic Industries Corporation.
UNIDO	United Nations Industrial Development Organization.

BF/BOF	Blast Furnace Basic Oxygen Furnace Steelmaking route.
DRI	Direct Reduction Iron.
DR/EAF	Direct Reduction Electric Arc Furnace Steelmaking route
HyL	Technology for Production of Sponge Iron.
UHP/EF	Ultra High Power Electric Furnace

ABBREVIATIONS (cont'd)

GDP	Gross domestic product.
MTPY	Million metric tonnes per year.
tph	tonnes per hour
MVA	Manufacturing value added
Tonne/ton	Metric tonne
$US	United States Dollar
...	Figures are not available.

Chapter I

OVERVIEW OF THE ECONOMIC SITUATION IN THE WESTERN ASIAN REGION

The ESCWA region is relatively small in terms of population, gross product and area of arable land. The basic characteristics of the region are listed in the annexes.

The region includes countries which enjoy levels of per capita income among the highest in the world, while others belong to the group of least developed countries. In the light of overall economic and social performance and level of GDP, the countries of this region may be classified into three groups: the oil-producing economies, the diversified economies and the least developed economies.

The oil producing economies[1/] depend almost exclusively on the oil sector as a major source of income. In spite of a considerable decline in output and export of oil since 1981, these countries have the highest share of GDP in the region amounting to $US 187,284 million or 60.5 per cent of the total GDP of the region in 1984 when per capita income amounted to $US 10,825.

The share of major sectors of the economy in total GDP is distributed as follows: mining sector - 25.8 per cent, manufacture - 8.1 per cent, agriculture - 2.4 per cent. The population of the oil-producing countries amounted to 14 per cent of total population of the region. More than 80 per cent of the economically active population is engaged in transport, trade and other services.

Most of the countries with diversified economies [2/] with the exception of Iraq are less dependent on oil revenues; however, their economies are linked with oil-producing economies through official transfer of capital and the remittances of their nationals working in major oil-exporting countries. The population of these countries represent around 78 per cent of the total population in the region. The GDP of the diversified economies accounted for more than $US 79,200 million, contributing around 38 per cent of the total GDP to the region in 1984. Per capita GDP amounted to $US 1,508. The share of the manufacturing sector in the total GDP was 10.8 per cent; the mining sector accounted for 12.5 per cent and the agricultural sector was 12.6 per cent in 1984. Around 20 per cent of the economically active population is engaged in mining, manufacturing, construction and utilities while approximately 50 per cent are in transport, trade and other services.

1/ Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates.

2/ Egypt, Iraq, Syria, Jordan and Lebanon.

The economies of the least developed countries (the Yemen Arab Republic and the People's Democratic Republic of Yemen) are the most vulnerable to the economic conditions prevailing in the region, due to their low level of economic development and scarcity of resources. These two countries, by and large, depend on remittances in offsetting their high level of trade deficit. The population of the two countries was around 9.7 million in 1984. The GDP of these countries was around $US 5,100 million or 1.6 per cent of the region's total GDP. Per capita GDP amounted to $US 510. The share of the mining sector represented 0.02 per cent only, while the share of agriculture was 18.9 per cent, and that of the manufacturing sector 10 per cent. The share of other sectors was highest, accounting for around 20 per cent. Most of the population is engaged in agriculture, fishing, commerce, services and government employment.

The region comprises some of the most open economies among the developing countries and is vulnerable to external factors. Owing to favourable terms of trade for petroleum since 1973 the region used to be a major source of surplus financial capital. The world's economic growth and recovery at the beginning of the 1980s did not lead to any rise in oil revenues in the Gulf countries. This was partly due to the increase in the use of other sources of energy since the mid-1970's energy conservation measures and improved efficiency in utilization of energy in general . Thus, the ESCWA region's oil revenues in 1985 were only $US 76.5 billion or 43.5 per cent of that received in 1980 when the ESCWA region revenues reached a peak of $US 176 billion.

In energy resources the ESCWA region is one of the world's richest, containing about 50 per cent of the world's proven petroleum resources. The ESCWA region's share in world reserves of natural gas exceeded 12 per cent in 1984, with the expected life of the reserves extending over three centuries. In addition, the region is known to contain abundant supplies of phosphates, sulphur, potash and other minerals, though the full extent of the subregion's mineral wealth is not yet known.

Thus even though relatively small in size, the Western Asia region plays two crucial roles in the world economy. First, it is the main source of petroleum exports in the world. Second, due to favourable balances from time to time, this region is a major source of surplus financial capital. To a considerable extent, this factor is influenced by developments in the major oil-exporting economies with their spill-overs to other countries in the form of remittances, aid contributions and increased imports.

The pattern of industrialization in most countries of the region has not changed significantly since mid-1970 in spite of the rapid growth in the economy. The manufacturing industry is still largely limited to light and consumer-oriented commodities. The imbalance in the structure of the manufacturing sector in the region is reflected in the limited contribution of fabricated metal products, machinery and equipment, which was around 8.8 per cent of MVA in 1980 as shown in the table below.

Table I.1.1. Percentage distribution of value added by main branches of industry in the ESCWA region, 1975 and 1980

	1975	1980
Food, beverages and tobacco	13.6	13.5
Textiles and wearing apparel	16.7	13.0
Wood and wood products	2.9	2.7
Paper products, printing and publishing	0.9	1.0
Chemicals, petroleum refining, plastics and rubber	41.2	45.3
Non-metallic products	8.1	8.5
Basic metal industries	1.0	1.2
Fabricated metal industries	11.2	8.8
Other manufacturing industries	4.4	6.0
Total	100.0	100.0

Source: United Nations Economic and Social Commission for Western Asia, Survey of Economic and Social Developments in the ESCWA region, (E/ESCWA/DPD/85/4).

Chemical industries, petroleum refining and plastics remain the major contributors to MVA, representing 45.3 per cent of the total MVA in 1980. The oil Gulf countries' share was the highest, contributing around 86 per cent of the region's value added in chemicals. Food industries take the second place, representing around 13.5 per cent of total MVA in the ESCWA region. The food industry has been concentrated in the non-oil countries (diversified economies), mainly in Egypt, accounting for more than 90 per cent of the region's MVA in this industry. The share of the textile industry in total MVA was 13 per cent in 1980. Most of this industry is concentrated in Egypt, Syria and Iraq (87 per cent of the region's value added in textiles).

Total contribution of the metal industries to the MVA amounted only to 10 per cent in 1980 while the average annual share of those branches in MVA of the developed world was around 40 per cent during the last decade. Non-metallic mineral products composed mainly of cement and building materials, contributed around 8 per cent of MVA in both oil and non-oil countries. This branch experienced a high rate of growth due to the vast increase in demand for construction and infrastructural development, particularly in the transportation and communications systems.

Since 1980, the manufacturing sector has been given increasing priority in the development plans of member countries. The planned investment for the period 1981-1985 for the industrial sector in ESCWA countries is estimated at $US 101 billion, including $US 58.7 billion for the manufacturing sector or an equivalent of more than twice that implemented for the period 1976-1980 ($US 42.7 billion).

Considerable priority is accorded to the manufacturing sector; however, the region is mainly known as a major world oil source. Oil production in the ESCWA region recorded a 1.0 per cent growth rate in 1984 and it is expected to be increased.

Meanwhile, the stated long-term strategy of the region is based on the consideration that the total supply of oil is limited. The strategy is:

(a) To extend the life-span of this non-renewable resource to the maximum efficient period; and

(b) To convert the economies from the period of development based on oil revenues to a period of self-sustaining development oriented primarily to the non-oil sector before the end of oil resources in the region.

In the light of these considerations, it becomes important to develop the element of a long-term industrialization strategy for the ESCWA region. Industrial strategy for the ESCWA region should not be seen as a mere import substitution policy. This policy alone may no longer play a leading role in the industrialization process for a number of countries of the region. These countries are poised for entry into what is sometimes referred to as the second phase import substitution calling for establishment of intermediate products for supplying the existing industries as well as the development of engineering industries including capital goods industries. These industries are usually characterized by a relatively higher level of manpower skills, including management, and higher economies of scale.

In view of the above, it may be concluded that one of the most important factors in formulating the industrial strategy in the region is the development of the iron and steel industry.

Chapter II

MARKET FOR THE IRON AND STEEL INDUSTRY AND ITS POTENTIAL

A. Recent development in world iron and steel and position of the ESCWA countries

The world iron and steel industry is obviously going through a crisis. World steel production has been showing a downward trend since the end of the last decade (see figure 1). There are mainly two reasons behind the world-wide steel industry crisis and they are as follows:

(a) Developed countries have passed the stage of expansive economic growth and have completed their basic industrialization. After two centuries, the iron and steel industry is running out of steam in these countries. Used steel production facilities are undergoing modernization, renovation and reinvestment; and

(b) The second reason refers to recent technological developments. This could apply to both developed and developing countries, but is probably more applicable to the former group than the latter. Such technological developments result in a reduction of steel consumption per unit of GDP. These technical developments can be summed up in three trends:

- The improvement in design (reduction of weight or size of steel objects);

- The use of stronger, therefore lighter, steel in place of heavier steels;

- Substitution of other materials for steel.

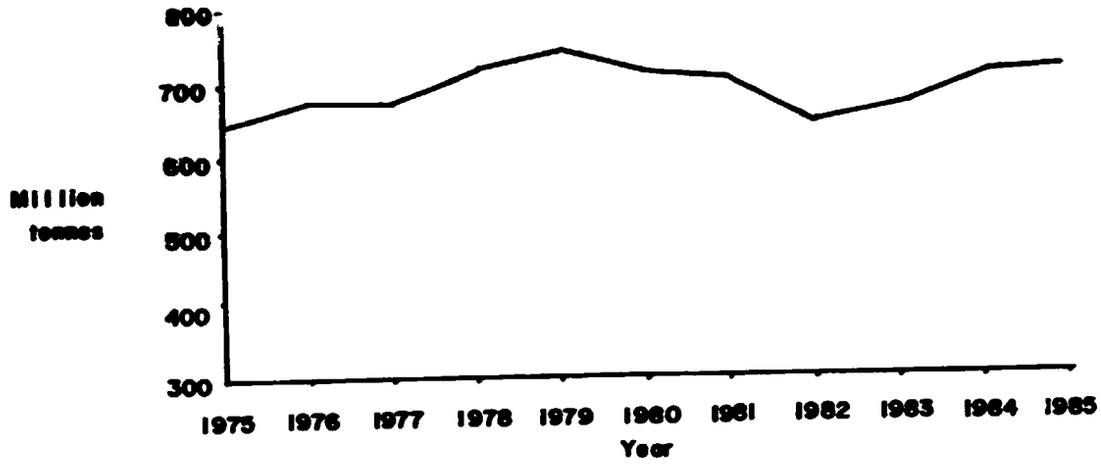
In addition, a complicating factor was added when many firms in the developed market economies incorrectly interpreted the signs of decelerating demands as merely cyclical aberration with no prolonged structural impact.

Early in the 1980s more than half of the world's steel was produced by the developed market economies and about 30 per cent by the centrally planned economies. The balance of 16.7 per cent was produced by developing countries. The Soviet Union ranked first among producing countries, followed by Japan, the United States of America, the Federal Republic of Germany, People's Republic of China, Italy and France.

The massive investment programmes begun in the early 1970s, were continued despite shrinking levels of world demand. The rate of growth in world steel capacity actually accelerated in 1975-1977, even though the major markets had already begun long-term recontraction.

FIGURE 1

WORLD STEEL PRODUCTION IN CRUDE STEEL EQUIVALENTS



Source: International Iron and Steel Institute

The general outlook for the steel industry was less than bright at the beginning of the 1980s. One must realize that for the developing countries as a group, the prospects for the steel industry are fair. The following table shows that developing countries decreased steel production in 1981-1982; nevertheless, they had a persistent average annual growth rate of 5.2 per cent from 1979 to 1984.

Table II. 1.1 World production by major economic groups 1979-1984
(in crude steel equivalents)

	Steel production (million tonnes)					Change (%)			Annual growth rate
	1979	1981	1982	1983	1984	1981 over 1979	1982 over 1981	1983 over 1982	1979-1984
Centrally planned econ.	209.4	206.1	203.5	211.1	213.9	-1.5	-1.3	+3.7	+0.3
China, DPR Korea	39.9	41.1	42.9	45.8	49.9	+3.0	+4.3	+6.7	+3.8
Industrialized market economies	442.8	400.3	337.8	343.0	371.3	-9.6	-15.6	+1.5	-2.9
Developing countries	54.6	58.5	60.3	63.6	74.1	+7.1	+3.1	+5.4	+5.2
World	746.7	706.0	644.5	663.5	709.2	-5.5	-8.7	+3.0	-0.9

Source: 1. Iron and Steel International, Vol. 51, No. 2, April 1984.
2. UNIDO, The Iron and Steel Industry: Present Situation, Prospects and the Need for More Integrated Development of the Iron and Steel and Capital goods Industries, Issue Paper I, 21 February 1986 (ID/WG.458/11).

In 1984, seven developing countries (five in Asia and two in Latin America) accounted for 87.5 per cent of the iron and steel production of developing countries.

Recently estimated world annual production capacity is about 1 billion tonnes comprising some alternative routes for steel production. The traditional blast route using coke to produce pig iron is being replaced by the direct reduction route and other modern technology based on electric arc furnaces.

Total crude steel output in market economies is still expected to increase by about 2 MTPY between 1984 and 1986. During that period, 15 MTPY of capacity is expected to close and to be replaced by 17 MTPY of new capacity, while some 23 MTPY is expected to be added by centrally planned economies between 1984 and 1989.1/

1/ See "World Iron and Steel Events", Arab Steel Acier Arabe, No.130, 1985.

At the beginning of 1984 the western world's electric steel furnaces operated at an estimated 74 per cent of total capacity of 180 MTPY; basic oxygen converters worked at 63 per cent of 452 MTPY capacity; open hearths operated at 69 per cent of 27 MTPY capacity.

In 1984 the structure of crude steel output manufactured through different routes was as follows:

	Western world	Planned economies
Oxygen steel	- 65.1 per cent	33.5 per cent
Electric steel	- 30.3 per cent	13.3 per cent
Open hearth	- 4.6 per cent	53.0 per cent

In centrally planned economies, open hearths accounted for an estimated 53 per cent of total output.[1/]

In the 1970s steel consumption increased substantially in centrally planned economies and developing countries, but it stagnated in industrial market economies. Consumption of steel in industrial market economies amounted to 61.6 per cent of total world steel consumption in 1970, followed by centrally planned economies (25.8 per cent) and developing countries (12.6 per cent). Early in the 1980s the share of industrial market economies was 47.2 per cent of the total, while the share of centrally planned economies accounted for 38.4 per cent and developing countries 14.4 per cent. The annual growth of world steel consumption for this period was only 0.9 per cent compared with 6.0 per cent in the 1960s. The 1980s witnessed a slowdown of the annual growth rates in industrialized market economies (-1.2 per cent) and recorded an increase of these rates in centrally planned economies of (+3.8 per cent) and developing countries (+1.8 per cent).[2/]

In the forecasts made by IISI in the mid-1970s,[3/] the demand for steel was expected to increase and to reach the peak of the five year steel cycle in the mid-1980s. The total world steel demand was expected to reach 1.144.4 million tons in 1985 up from 939 million tons in 1980. The actual figures for these years are as follows:

1980 - 727,8 million tonnes, and
1985 - 722,6 million tonnes.

In 1984 the total consumption of steel was 715 MTPY. The most relevant aspects of consumption and production balances were the serious deficit in the United States of America and developing countries and the significant increase in the surplus of Japan and the EEC countries. Centrally planned economies have practically achieved a balance between consumption and production (see table II 1.2).

1/ Steel Statistical Yearbook 1986, IISI.

2/ See: (a) "Structural changes in the Iron and Steel Industry". Study, Economic Commission for Europe, United Nations, New York, 1979; (b) L.J. Holsehuh, "The World Steel Situation: an IISI View". "All Ta'awon Al-Sina'e". "Industrial Co-operation in the Arabian Gulf", GOIC, Issue No.15, Fourth year, April 1983.

3/ Projection 85 World Steel Demand IISI 1972.

Table II 1.2. Balances of steel consumption and production in 1984

(million tonnes of crude steel equivalent)

Economic groups	Consumption	Production	Balance
Centrally planned economies	214.0	213.9	- 0.1
China, DPR Korea	65.0	49.85	-15.15
Industrialized market economies			
Total:	339.0	371.3	+32.3
USA	115.0	84.5	-30.5
EEC(10) countries	93.0	120.2	+27.2
Japan	74.0	105.5	+31.5
Other industrialized market economies	57.0	61.1	+ 4.1
Developing countries	97.0	74.09	-22.91
ESCWA region[a/]	6.2	1.9	- 4.3
Total World	715.0	709.14	- 5.86

Source: UNIDO, the Iron and Steel Industry Present Situation, Prospects and the Need for More Integrated Development of the Iron and Steel and Capital Goods Industries. Issue Paper I. 21 February 1986. p. 8. (ID/WG.458/11). Certain figures have been revised.

a/ Estimation based on the data available in the joint ESCWA/UNIDO Industry Division.

The annual rate growth of consumption by developing countries for the period 1980-1985 estimated by the IISI was 1.6 per cent. Actual consumption of steel in these countries accounted for 97 MTPY in 1984. For the period 1985-1995 the forecast rate of growth of consumption in developing countries will be even greater, 2.8 per cent while the consumption of developed countries will continue to decrease at an annual rate of 0.5 per cent.[1/]

The iron and steel industry is not new to the Arab world. The first steel plant was established in Egypt in 1947, and then some steel manufacturing plants were launched in almost all countries of the Arab world. In 1982 actual designed capacities in the Arab world were as follows:

Iron production - 4.5 MTPY
Crude steel production - 4.7 MTPY
Rolled steel production - 6.1 MTPY
Tube production - 0.8 MTPY

In 1983 the total output of crude steel in Arab countries amounted to 2.5 MTPY and the actual production of rolled products was about 3.2 MTPY (see table 2, annex I). Demand for rolled products has been doubled since 1974 and accounted for 10.5 MTPY in 1983.

1/ UNIDO, "The Iron and Steel Industry: Present Situation, Prospects and the Need for More Integrated Development of the Iron and Steel and Capital Goods Industries", Issue Paper I. 21 February 1986, (ID/WG.458/11).

The total capacity for rolled products reached 7.7 MTPY in 1985 but the Arab world remains so closely dependent on foreign suppliers to meet its own demands for all kinds of steel commodities. This reveals that the steel manufacturing plants in the Arab world are working at 40 to 60 per cent of their designed capacities which thus means a widening gap between supply and demand. This is due to many reasons, among which are the following:

- The insufficiency of skilled personnel to be employed or to carry out work;

- The workers' drain and their instability due to problems of salaries, housing, inadequate transport, communication;

- The deficiency of maintenance programmes and inadequate implementation of those that are available to ensure designed efficiency;

- The lack of the necessary spare parts for long-time operating equipment;

- An inadequacy of raw materials according to necessary specifications.

However, the projects which are under way or in the planning phase in several Arab countries are designed to reduce this gap.

Schematically, the Arab iron and steel-producing countries can be classified in three major groups:1/

The North African group: Algeria, Libyan Arab Jamahiriya, Mauritania, Morocco, Tunisia

The Middle Eastern group: Egypt, Jordan, Lebanon, the Sudan and Syria

The Gulf group: Iraq, Kuwait, Qatar, Saudi Arabia, Bahrain, Oman and the United Arab Emirates

The last two groups, excluding the Sudan, comprise the ESCWA region with the People's Democratic Republic of Yemen and the Yemen Arab Republic.

The iron and steel industry in the ESCWA region consists of a number of modern iron and steel manufacturing plants. The first open hearth furnace operation began production in Egypt at Abu-Zaabal in 1949. The Ahlia plant was the next in 1953. The first Arab integrated steel factory was also opened in the region in 1958 (Egypt). Modern generation electric furnaces in semi-integrated plants were installed in Egypt in the 1950s and 1970s. Recently, direct reduction has started, the first plant adopting it being the Qatar Steel Plant (QASCO) in 1978. This was followed by 400,000 tonnes capacity plant in Iraq and the Saudi Iron and Steel Co. (HADEED) at Jubail in Saudi Arabia with an 800,000 tonnes annual capacity.

1/ Based on the classification proposed by the Arab Iron and Steel and Metallurgical Institute reproduced from the Arab Metallurgical News. No.72. 1983.

The iron and steel industry in the ESCWA region is characterized by a wide diversity in the type of plants in the various countries (see table 3, annex I).

The region's production capacities accounted for only 0.5 per cent of the world's installed capacities in 1982: the region produced only 0.3 per cent of the total amount of the world's crude steel, while the region's total demand for finished steel products was about 1.5 per cent of the world demand in 1982.1/

The structure of the actually installed capacity in the region in 1982 was the following:

- Iron production - 2.5 MTPY or 55 per cent of total Arab world
- Crude steel production - 3.1 MTPY or 65 per cent of total Arab world
- Rolling steel production - 3.3 MTPY or 60 per cent of total Arab world
- Tube production - 0.3 MTPY or 40 per cent of total Arab world

In 1983 the total output of crude steel reached 1.3 MTPY; finished steel output amounted to 2.1 MTPY.

Most of the existing iron and steel plants in the region have been built on the basis of individual local needs and resources of the region's countries in the light of localized economic and industrial policies. Therefore, it would not be an exaggeration to say that so far there has not been due emphasis on balanced linkages with the pace-setting industries, (namely, capital goods and consumer-durable industries) in development of the region's iron and steel. In turn, this limits the creation of coherent national and regional productive systems and of integrated development of different sectors within a country as well as their regional co-operation.

B. Demand and supply - present status

Almost all countries of the Arab world are participating in the production of some forms of iron and steel products. The production of steel increased in the Arab world from 265,000 tonnes in 1965 to 1.6 million tonnes in 1975 and 4 million tonnes per year in 1980. The estimates made by different Arab and international institutions placed the consumption of finished steel products in the early 1980s at approximately 10-10.5 million tonnes per year. Assuming a conservative growth rate of about 5 to 7 per cent per year proposed by these Arab and international organizations, the demand for steel in the total Arab world can be expected to increase as follows:2/

1/ ESCWA estimation based on Steel Market in 1982 (ECE/Steel/42) and Structural Changes in the Iron and Steel Industry, (ECE/STEEL), 1979 Papers of AISU Rolling Mills Symposium, Damascus, June 1985.

2/ - "The current situation in the field of rolling in the Arab World and the demand expectation for rolled steel products between 1990-2000" by the AISU general secretariat, Arab Steel (Acier Arabe), No. 133, June 1985;
- Arab Metallurgical News, No. 172, December 1983;
- UNIDO, Tentative projection of steel demand in the ESCWA region, Sectoral Studies Branch, Division for Industrial Studies, Vienna, 28 October 1985.

Million tonnes per year

Names of Institutions	1990	1995	2000
AISMI	21.0	26.9	33.5
AISU -	20.7	26.3	32.6
UNIDO (as optimal scenario for the ESCWA region)	15.1	20.7	28.1

The data published by AISMI for a 15 year projection of both the demand volume and the capacities planned for the manufacture of steel products in the Arab countries by the year 2000 show that production capacities are expected to be lower than the demand level (see table II.2.1). According to AISMI only about 79 per cent of the requirements are expected to be met in 1985. This rate will progressively decrease to 67 per cent by the year 2000. This means that the projected production capacities will be unable to cover the increasing demand for finished products. The gap between supply and demand should be on the order of 11 million tonnes by the end of the century.

Table II.2.1. Estimates of production capacities and demand for finished steel products in the Arab world in 1985 - 2000

('000 Tonnes)

Years	Products range	Demand estimates	Installed and projected production capacities	Gap between demand and installed capacities
1985	Reinforcing rod	8,249.8	7,153.6	1,096.2
	Sections	3,245.8	1,885.0	1,360.8
	Flat products	4,198.8	2,415.0	783.8
	Total	15,694.4	11,453.6	3,240.8
1990	Reinforcing rod	10,960.0	9,392.6	1,567.4
	Sections	4,406.8	2,275.0	2,131.8
	Flat products	5,707.1	2,415.0	2,292.1
	Total	21,073.9	14,082.6	5,991.3
1995	Reinforcing rod	13,910.5	11,462.0	2,448.5
	Sections	5,606.5	3,359.0	2,247.5
	Flat products	7,413.6	6,665.0	748.6
	Total	26,930.6	21,486.0	5,444.6
2000	Reinforcing rod	17,074.3	11,906.0	5,168.3
	Sections	6,962.3	3,859.0	3,103.3
	Flat products	9,542.1	6,665.0	2,877.1
	Total	33,578.7	22,430.0	11,148.7

Source: Arab Metallurgical News, Arab Iron and Steel and Metallurgical Institute, No.172, December 1983. Certain figures have been revised.

The other estimates, made by AISU, assumes that no change is foreseeable in the structure of demand for finished products in the Arab countries by 2000. Reinforcing bars, are expected to continue to rank first among the products in demand, reflecting the heavy demand of the building sector. This commodity is understood to account for 52 per cent of demand in 1985 and for 51 per cent at the end of the century. Flat products are expected to account for 27 per cent of demand in 1985 and for 28 per cent by the year 2000. The volume of demand for sections is forecast to be of the order of 20 per cent during the same period[1/]. In table II.2.1 one can see that by the end of the century, the region will require net imports of at least 11 million tonnes per year of major finished steel products alone. The gap between production and consumption will continue, and it is not expected to be bridged even if the plants work at their full designed capacities. This gap is sufficient to justify an accelerated expansion of the domestic steel industries.

In most of the ESCWA countries, plans have been made and are in execution stage for the development of the steel industry in the 1980s, either by installing new fully integrated plants like in Saudi Arabia and in Iraq or semi-integrated plants, mills of different types or expansion of existing plants as is being done in Egypt. These plants are at different stages, from ideas for future development to actual plants under construction.

The total capacity for the manufacture of finished steel products in the ESCWA region was 3.7 million tonnes in 1980 and amounted to 4.9 million tonnes in 1985. Some countries of the region were not able to achieve their ambitious plans due to the emergence of unexpected political and economic developments in the region (see table II.2.2).

The greatest increase in capacity was reached by Gulf countries from 1980 to 1985 with the average annual growth rate of 11.3 per cent while the average annual growth rate in non-Gulf countries accounted for only 2 per cent. Egypt and Saudi Arabia are the major holders of the installed capacity in the region (58 per cent).

Between 1985 and 1990 some countries of the region intend to modernize their production capacity and increase industrial output in the coming years. There may be a few steel projects for the People's Democratic Republic of Yemen and the Yemen Arab Republic. According to the IISI estimation the demand for iron and steel products in the region is expected to be increased from 5.4 million tonnes in 1980 to 9.7 million tonnes in 1985 and 13.1 million tonnes and 19.2 million tonnes in 1990 and in 2000 respectively (see table 4, annex I).

1/ "The current situation in the field of rolling in the Arab world and the demand expectations for rolled steel products between 1990-2000". AISU general secretariat. Arab Steel (Acier Arabe), No.133, June 1985.

Demand for certain finished products is closely related to particular sectors of the economy. Steel rails and other railway materials are required in the development of the railway system; tubes and pipes are used predominantly by the oil-producing industry; tinplate is sold to the canning industry, which in turn generally depends on the export of canned food products; and demand for wire products is associated with animal husbandry and agrarian reform programmes. Usually, the building and construction industry is active in the early stages of industrialization, and this promotes the use of bars, light sections and galvanized roofing materials.

Because of non-availability of appropriate statistical data, it is impossible to compare the patterns of consumption of steel within the sectors of economy in the ESCWA countries. However, the percentage distribution of imported steel products in the ESCWA region (table II.2.3) shows that the major consumers are the construction industry (sections) and infrastructural system (tubes and fittings). Some other products are used in the construction industry as well as gas, water and electricity systems.

Table II.2.2. Planned and existing capacities for finished steel production in the ESCWA region

(000 tonnes)

	Expectation			Actual existing in 1985
	1980	Expected increment up to 1985	Total expected installed capacity in 1985	
Egypt	1875	1550	3425	1910
Syria	140	490	630	140
Jordan	166	230	396	396
Iraq	455	880	1335	455
Kuwait	160	-	160	160
Saudi Arabia	140	800	940	940
Qatar	330	-	330	330
U.A.E	111[a/]	...	...	154
Lebanon	420	-	420	420
Bahrain	-	25	25	-
Total	3797	3975	7661[b/]	4905

Source: Compiled by the Joint ESCWA/UNIDO Industry Division derived from:

- Arab Iron and Steel Union, Statistics Published and presented to the Second Arab Congress on Steel Industry, Bahrain, 1982;
- AISU Paper on Rolling Mills Symposium (Damascus June - July 1985), Arab Steel (Acier Arabe), No.133, June 1985;
- AIDO, Study on Iron and Steel Industry, 1980.

a/ In 1978

b/ Except for U.A.E.

Table II.2.3. Percentage distribution of semi-finished and finished steel products imported into the ESCWA region

Type of products	1981	1982	1983
- Ingots and semis	5.9	5.3	6.1
- Heavy sections	4.6	4.6	5.6
- Light sections	41.0	45.2	42.2
- Plates	5.3	4.6	4.6
- Sheets (less than 3mm)	9.0	8.3	9.8
- Strip	1.4	1.3	1.7
- Tinplate	1.3	1.1	1.4
- Railway track material	0.6	1.8	2.2
- Wire rods	2.2	2.6	3.4
- Wire	1.2	2.0	1.9
- Tubes and fittings	24.8	19.3	20.3
- Wheels, tyres and axles	0.05	0.06	0.2
- Others	2.65	3.84	0.6
Total products	100.0	100.0	100.0

Source: Compiled by the Joint ESCWA/UNIDO Industry Division based on Statistics of World Trade in Steel. Economic Commission for Europe, New York, 1984.

Hence, it may be no exaggeration to say that the major consumers of steel products in the ESCWA region are the construction industry and the industrial infrastructure. More than 70 per cent of the total produced and imported steel products, bars, rods, sections, rails, pipes, tubes and some quantity of flat products, are consumed by these two sectors (see table II.2.4).

In this connection, it must be realized that the steel demand pattern in the ESCWA countries is not the same as in the developed countries. Table II.2.5 shows the pattern of consumption of steel in the United Kingdom, Japan and Federal Republic of Germany in 1983. This illustrates the pattern in developed economies. It may be noted that from 73.2 per cent in the United Kingdom to 91.6 per cent in the Federal Republic of Germany, steel is consumed by manufacturing industries, while the share of construction industries is only 5.8 per cent in FRG to 22.2 per cent in Japan.

It is to be noted in this connection that the region is reaching a phase of gradual completion of its construction and infrastructural facilities; housing, tourism facilities, storage, pipelines, etc. Thus, in the near future, the region might face a slowing down in the internal market consumption of the basic steel products. Unless intensive development of manufacturing downstream industries will be able to bring about a new impulse to demand for steel products.

Table II.2.4. Import of semi-finished and finished steel products by commodity into the ESCWA region (thousand metric tonnes)

Product Destination	Year	Ingots and semis	Heavy Sections	Light Sections	Plates	Sheets (less than 3mm)	Hoop and Strip	Tinplate	Railway track material	Wire rods	Wire	Tubes and fittings	Wheels, tyres and axles	Total product
Middle East	1981	499	519	4,160	512	707	138	110	77	255	196	2,229	4	9,406
Total	1982	586	225	5,565	233	1,228	89	66	158	233	961	966	4	10,314
	1983	450	242	5,171	353	862	109	131	129	229	353	1,525	8	9,562
Bahrain	1981	-	4	24	6	6	-	-	-	3	2	18	-	63
	1982	-	9	55	8	4	1	-	-	7	1	16	-	101
	1983	-	6	19	6	4	1	-	-	2	2	14	-	54
Egypt	1981	71	48	319	52	71	8	42	11	29	16	104	3	774
	1982	1	42	445	43	53	9	34	50	66	17	186	1	947
	1983	27	64	511	48	85	10	51	77	139	24	175	6	1,217
Jordan	1981	141	14	60	8	23	5	3	1	3	7	23	-	288
	1982	110	13	59	9	26	3	5	-	8	6	51	-	290
	1983	74	14	76	8	19	1	3	-	6	4	29	-	234
Kuwait	1981	8	65	456	73	74	18	5	16	30	9	77	-	831
	1982	63	47	508	55	84	16	2	1	28	9	117	-	930
	1983	16	38	352	49	51	20	33	-	17	14	17	-	607
Lebanon	1981	111	7	48	83	42	13	8	-	14	6	15	-	347
	1982	90	13	66	15	52	11	7	-	17	6	25	-	302
	1983	83	20	127	23	49	9	7	2	20	5	22	-	367
Iraq	1981	24	73	606	43	74	16	13	26	32	32	426	-	1,365
	1982	54	47	518	31	124	16	7	33	34	44	158	3	1,069
	1983	8	21	326	12	42	10	15	26	12	20	45	1	538
Saudi Arabia	1981	139	182	1,858	165	263	48	21	22	71	69	1,096	1	3,935
	1982	229	→	3,362	→	735	11	-	73	55	855	-	-	5,320
	1983	214	→	2,973	108	454	10	-	24	-	248	771	-	4,802
Syria	1981	53	56	399	45	71	29	14	-	10	35	46	-	758
	1982	35	4	63	8	35	8	9	-	4	6	15	-	187
	1983	14	14	137	23	27	15	9	-	11	5	38	-	293
Other Middle East[1/]	1981	2	70	390	97	83	4	4	1	13	20	424	-	1,108
	1982	4	50	489	64	115	14	2	1	14	17	428	-	1,198
	1983	14	65	590	76	131	33	13	-	22	31	414	1	1,390

Source: Economic Commission for Europe. Statistics of world trade in steel, New York, 1981, 1982, 1983, 1984.

Note: a) - Less than 1,000 tonnes
b) → Together with the products pointed

1/ Other Middle East: Democratic Yemen; Gaza Strip; Neutral Zone; Oman; Qatar; United Arab Emirates; Yemen.

Table II.2.5. Consumption of iron and steel products by sectors of the economy in some developed market economies

	United Kingdom		Japan		German F. Republic	
	000t	%	000t	%	000t	%
- Manufacture of machinery (excluding electrical)	455	7.8	948	4.8	393.2	8.9
- Manufacture of electrical machinery	188	3.2	1546	7.8	317.6	7.1
- Shipbuilding	115	2.0	2328	11.8	107.9	2.4
- Motor vehicles, cycles and aircraft	680	11.7	5903	30.0	2175.0	48.8
- Manufacture of other metal products	2809	48.4	4602	23.4	1087.4	24.4
Total manufacturing	4247	73.2	15327	77.8	4081.1	91.6
- Housing, other buildings and civil engineering	255	4.4	4370	22.2	168.9	3.8
- Mining sectors	405	7.0	-	-	-	-
- Other sectors	896	15.5	-	-	205.5	4.6
Total	5803	100.0	19697	100.0	4455.5	100.0

Source: Economic Commission for Europe. "The Steel Market in 1983" United Nations, New York, 1984.

C. Trends in apparent consumption in the ESCWA region

The actual consumption in a country during a period equals total deliveries of steel to consumers minus changes in steel stock. Since statistics of stock changes are often lacking, the sum of production and net imports is generally used as a proxy for steel consumption, and referred to in this report as, apparent consumption of steel products:

Apparent consumption = imports + production - exports.

Table II.3.1 shows apparent iron and steel consumption for the period 1975-1982.

With respect to export, only Qatar and Kuwait export iron and steel products, the latter in relatively small quantities.

The regional consumption in the year 1975 was 6.5 million tonnes; in 1982, it increased to reach 10.3 million tonnes, that is approximately double the amount in seven years. For different periods of time annual growth rates have been calculated for apparent consumption, and are shown in table II.3.1 Saudi Arabia has the highest growth rate, starting with 16.7 per cent for 1975-1980, 26.7 per cent for the period 1977-1982, and 19.2 per cent for the whole period of 1975-1982. Kuwait has the second highest rate of growth, with 13.9 per cent, 9.4 per cent and 15.3 per cent respectively. The annual consumption of most countries shows a great deal of fluctuation, and the total apparent consumption in the region shows an annual growth rate for the first 5 years of 8.9 per cent. The 1977-1982 growth rate is 9.5 per cent while for the whole period (7 years), the annual rate of growth is around 6.0 per cent. The region therefore has been passing through a period of high increases in apparent consumption.

Approximately 80 per cent of apparent consumption of the region comes through imports, thereby showing the great dependence of the region on imports.

The total regional imports of semi-finished and finished steel products amounted to 8.7 million tonnes in 1982 showing a seven-time increase since 1965. Annual growth rate of the imported steel products in total consumed steel accounted for 9.2 per cent in this period (see table II.3.2). Imports in all ESCWA countries were on the increase till 1980. Three countries (Bahrain, Kuwait and Saudi Arabia) kept their dynamic position in imports, till the year 1982, while the others had considerable fluctuations in the process.

Table II.3.1. Apparent consumption of steel for the period 1975-1982

Metric tonnes

Country/year	1975	1976	1977	1978	1979	1980	1981	1982	Annual growth rates % 1975-1980	1977-1982	1975-1982
1. Bahrain	44800	37410	74250	53059	30210	56964	59400	98590	4.9	5.6	12.0
2. Egypt	2072800	1882079	1582492	1935267	2455019	2672993	2073171	2775410	5.2	2.3	-2.3
3. Jordan	72000	203815	227054	190945	434282	285128	376031	198340	31.7	-2.5	15.5
4. Kuwait	315500	502642	550140	525352	647220	604665	767030	858580	13.9	9.4	15.3
5. Lebanon	247400	68800	293027	289400	237709	283960	282740	274980	2.8	-1.3	1.4
6. Iraq	1500800	1736291	439800	877000	2539450	1852140	1217110	796330	4.3	12.5	-8.6
7. Qatar	160000	119879	136648	159374	114725	115325	517573	191178	-6.3	6.9	-2.5
8. Oman	146000	129000	59571	49961	77756	91963	192846	261729	-8.7	34.4	8.7
9. Saudi Arabia	1039100	970352	1024499	1460257	3141345	2238000	30566000	4231000	16.7	26.7	19.2
10. Syria	446200	820313	693649	671997	963966	998861	824760	768299	17.3	2.1	8.1
11. U.A.E.	345000	793000	848000	577372	791357	849774	879139	882931	9.3	0.8	1.5
12. Yemen Arab Republic	...	...	...	...	...	...	...	...	...	...	...
13. People's Democratic Republic of Yemen	...	...	...	10585	18155	26901	10733	16663	...	9.5	12.0
Total	6589600	7263581	5929130	6800569	11451185	10076674	10257133	10354000	8.9	9.5	5.8
Imports/consumption (%)	66.2	69.9	68.4	76.5	81.8	81.2	88.9	83.2			

Source: Compiled by the Joint ESCWA/UNIDO Industry Division derived from:
- National Trade statistics of the ESCWA countries published in years 1977-1984
- Economic Commission for Europe. Statistics of World Trade in Steel, New York, Published in years 1977-1984
- "Arab Iron and Steel Union Forecast" by the AISU General Secretariat, GOIC publication, April, 1984.

Table II.3.2. Total imports of semi-finished and finished steel products by the ESCWA countries
(selected years)

	1965 000t	%	1970 000t	%	1975 000t	%	1980 000t	%	1981 000t	%	1982 000t	%	1983 000t	%
Bahrain	13.2	1.0	23.4	1.6	44.8	0.8	56.8	0.8	62.0	0.8	98.0	1.1	114.2	1.7
Egypt*	267.6	21.6	370.5	21.7	844.8	16.8	987.7	13.4	738.5	9.2	942.9	10.8	929.3	14.2
Iraq*	159.9	12.9	345.3	20.3	1491.3	29.5	1593.2	21.6	1208.7	15.1	928.8	10.6	354.8	5.4
Jordan	-	-	48.1	2.8	72.0	1.4	153.8	2.1	259.7	3.2	232.1	2.6	133.7	2.1
Kuwait*	134.9	10.9	113.4	6.7	272.2	5.4	493.2	6.7	745.9	9.3	846.1	9.7	696.8	10.6
Lebanon	204.6	16.5	227.3	13.3	247.4	4.9	285.1	3.9	287.3	3.6	306.0	3.5	274.5	4.2
Saudi Arabia*	244.0	19.7	192.4	11.3	1026.5	20.0	2220.8	30.2	2986.6	37.2	4121.5	47.1	2938.3	44.8
Syria	71.5	5.7	206.7	12.2	361.2	7.4	683.7	9.3	722.6	9.0	117.7	1.3	193.4	3.0
Others	143.4	11.7	172.3	10.1	698.3	13.8	868.1	12.0	1012.3	12.6	1162.9	13.3	918.7	14.0
Total ESCWA region	1239.1	100.0	1704.4	100.0	5058.5	100.0	7362.4	100.0	8023.6	100.0	8756.0	100.0	6553.7	100.0

Source: Compiled by the Joint ESCWA/UNIDO Industry Division based on Statistics of World Trade in Steel. Economic Commission for Europe, Geneva. Published in years 1980-1984.

* At least four countries have a share of imports amounting to more than 60 per cent of total imported products. They are:

1980		1982		1983	
Saudi Arabia	- 30%	Saudi Arabia	- 47.1%	Saudi Arabia	- 45.5%
Iraq	- 21.6%	Egypt	- 10.8%	Egypt	- 14.5%
Egypt	- 13.4%	Iraq	- 10.6%	Kuwait	- 9.2%
Total	65 %		68.5 %		69.1 %

The great decrease in consumption of steel in Iraq from 1.8 million tonnes in 1980 to 0.7 million tonnes in 1983 as well as the decline in its share of the region's total imports, from 21.6 per cent in 1980 to 5.4 per cent in 1983, affected to a large extent total steel consumption within the region.

There was a great jump in the ESCWA region's imports between 1978 and 1979, where imports of 1979 nearly doubled that of 1978. In 1982, Saudi Arabia, the largest importing country of iron and steel products, accounted for nearly half of the total imports of the region.

The average annual growth rate for the region's total imports has been estimated as follows:

In the period 1975-1980	13.7 per cent
In the period 1975-1982	8.2 per cent

The average annual growth rate for the whole period is 8.2 per cent. This increase of imports is not expected to continue at this rate, and the oil producing countries (main importers) are expected to have a lower rate of growth in imports, because the construction boom which they have passed through in the 1970s will decline.

Decrease of imports by about 20 per cent in 1983 in comparison with 1982 can be explained by the following:

- Perceptible decline in economy of the region;
- Gradual decline in the construction boom;
- Making better use of available stock;
- Putting into operation new capacities in the region;
- Emergence of unfavourable political and economic development, etc.

The share of the annually imported products used by construction and oil sectors of the region amounted to around 65 per cent in the years from 1980 to 1983. Sections, tubes and fittings were consumed practically by all countries of the region in large volume. In 1983, the total share of these products was 77 per cent for Kuwait, 70 per cent for Saudi Arabia, 62 per cent for Iraq and 64 per cent for Egypt. The total consumption of these imported products in Oman, Qatar, the United Arab Emirates and both Yemens amounted to 78 per cent of their total steel imports.

In the Arab countries consumption of steel has been concentrated mainly in oil fields, infrastructure and housing. The average yearly rate of growth was 13 per cent in the years 1965-1980, while in the highly industrialized countries of North America and Europe this index did not exceed annually 6.9 per cent in the years 1965-1979.[1/] Major trade partners of the region are the EEC countries and Japan. Table 5 (annex I) shows a dynamic penetration of Japan into the region's market. While the total share of seven EEC countries accounted for 48.7 per cent in 1981 and 26.3 per cent in 1982, the share of Japan's exports amounted to 48.5 per cent and 67.5 per cent in 1981 and in 1982 respectively.

1/ Structural changes in the Iron and Steel Industry, (ECE/STEEL/20), New York, 1979, p. 108.

The world statistics indicate that the high rates of growth in steel per capita consumption, besides Japan and the centrally planned economies, were in Latin America. The absolute record was set by Arab countries where net overall growth over the period 1965-1979 reached well over 600 per cent (1965 = 100 per cent).1/

About 88 kg per capita of steel products consumed in the region from 1977 to 1981, were imported, while the other 22 kg were manufactured within the region. The average per capita consumption of steel during this period amounted to 110 kg, demonstrating a rather impressive level of consumption compared to the average for developing countries as a whole (29 kg) and various developing regions, ranging between 15 kg in Asia and 97 kg in Latin America (see table 6, annex I). The trend of per capita consumption for ESCWA region shows a great deal of fluctuation. The average per capita consumption in the region was 90 kg in 1975 rising to 113 kg in 1982, an increase of 23 kg. The year 1979 registered the highest figure of 140 kg. Some countries registered high rates of growth in per capita consumption while others showed very low rates (see table II 3.3).

Table II. 3.3. Per capita apparent consumption in terms of product

Country	1975	1977	1978	1979	1980	1981	1982
1. Bahrain	164	256	178	99	181	184	297
2. Egypt	56	40	48	59	63	48	40
3. Jordan	26	78	63	138	87	111	56
4. Kuwait	314	485	435	506	446	537	572
5. Lebanon	89	107	107	89	106	105	100
6. Iraq	136	245	71	201	141	89	56
7. Qatar	935	690	751	1.876	430	2.086	741
8. Oman	190	73	59	89	103	206	276
9. Saudi Arabia	143	129	176	365	343	328	413
10. Syria	59	86	80	111	111	88	79
11. U.A.E.	1.079	1.401	891	1.150	1.170	1.153	1.107
12. Yemen Arab Republic	...	...	...	...	...	...	...
13. People's Democratic Republic of Yemen	6	6	6	10	14	5	8
Average	90	77	85	140	130	118	113

Source: Compiled by the Joint ESCWA/UNIDO Industry Division derived from:

- Table II. 3.1 from the present study;
- UNESCWA, 1973-1982 Statistical Abstract of the Region of the Economic Commission for Western Asia. Seventh issue. Baghdad, 1984.

1/ Structural changes in the Iron and Steel Industry, (ECE/Steel/20), New York, 1979, p. 109.

Per capita consumption of steel is one indicator of economic prosperity. Long-term trends in steel consumption are principally determined by the level of economic development and by the structure of the economy. Although short-term variations in steel consumption and overall economic activity will occur periodically, both steel consumption and gross national product continue to increase when the economy has reached industrial maturity.

For example, figures 2, 3 and 4 show the relationship between such characteristics for 1960-1984. These figures testify that during the period under review for all three countries there is a practically linear dependence between these variables - per capita steel consumption is increased with the increase of GNP, the figures are also a good confirmation of a general tendency of sharp increase of steel consumption during the initial stage of industrialization.

Relatively high per capita consumption distinguishes oil exporting countries from the others in the region. Average per capita consumption in these countries amounted to 178 kg in 1972 and 232 kg in 1982. In spite of high annual growth rates of domestic production in the GCC countries (annual steel production increases amounted to 26 per cent from 1972-1982), dependence on imports also remained high.

Table II.3.4 Development of supply and demand in the GCC Countries

	1972	1982	Average annual increase %
Production (000 tonnes)	70	705	26
Consumption (000 tonnes)	1123	8490	22.4

Source: Gulf Organization for Industrial Consulting, Strategic Plan for Developing Iron and Steel Industry in the Arab Gulf Region, vol. 3, 1985.

The contribution of local production for local consumption amounted only to 6.2 per cent in 1972 and 8.3 per cent in 1982.

Table II.3.5. Contribution of local production in local consumption in GCC countries

	1972		1982	
	Quantity	%	Quantity	%
Production (in thousand tons)	70	6.2	705	8.3
Consumption (in thousand tons)	1,123	100.0	8,490	100.0

Source: Gulf Organization for Industrial Consulting. Strategic Plan for Developing Iron and Steel Industry in the Arab Gulf Region, vol. 3, 1985.

Figure 2

Saudi Arabia

CAPITAL FORMATION IN AFRICA AND WEST ASIA

MODEL = LNCPCP = A + B (INYPC) : LOG - INVERSE
AFRICA AND WEST ASIA = 81

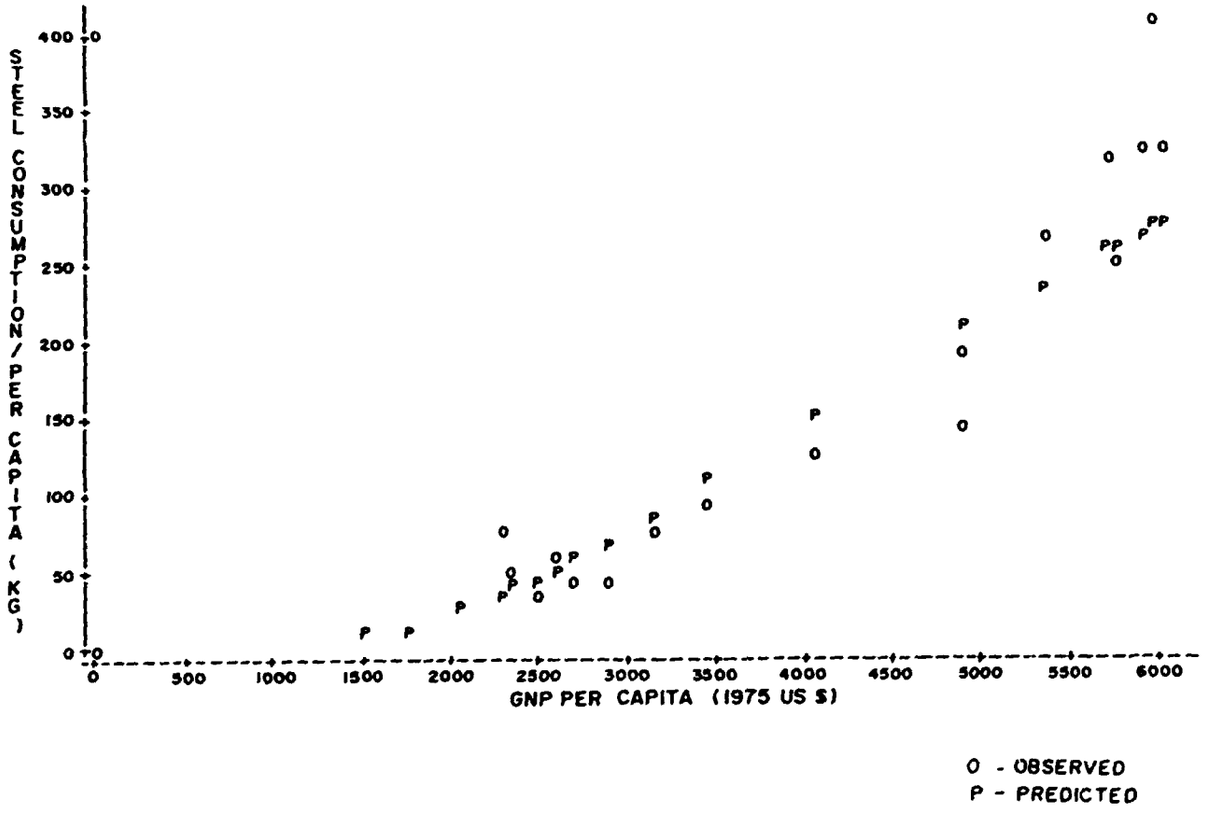


Figure 3

Egypt

MODEL = LNCPCP = A + B (INYPC) : LOG - INVERSE
AFRICA AND WEST ASIA = 818

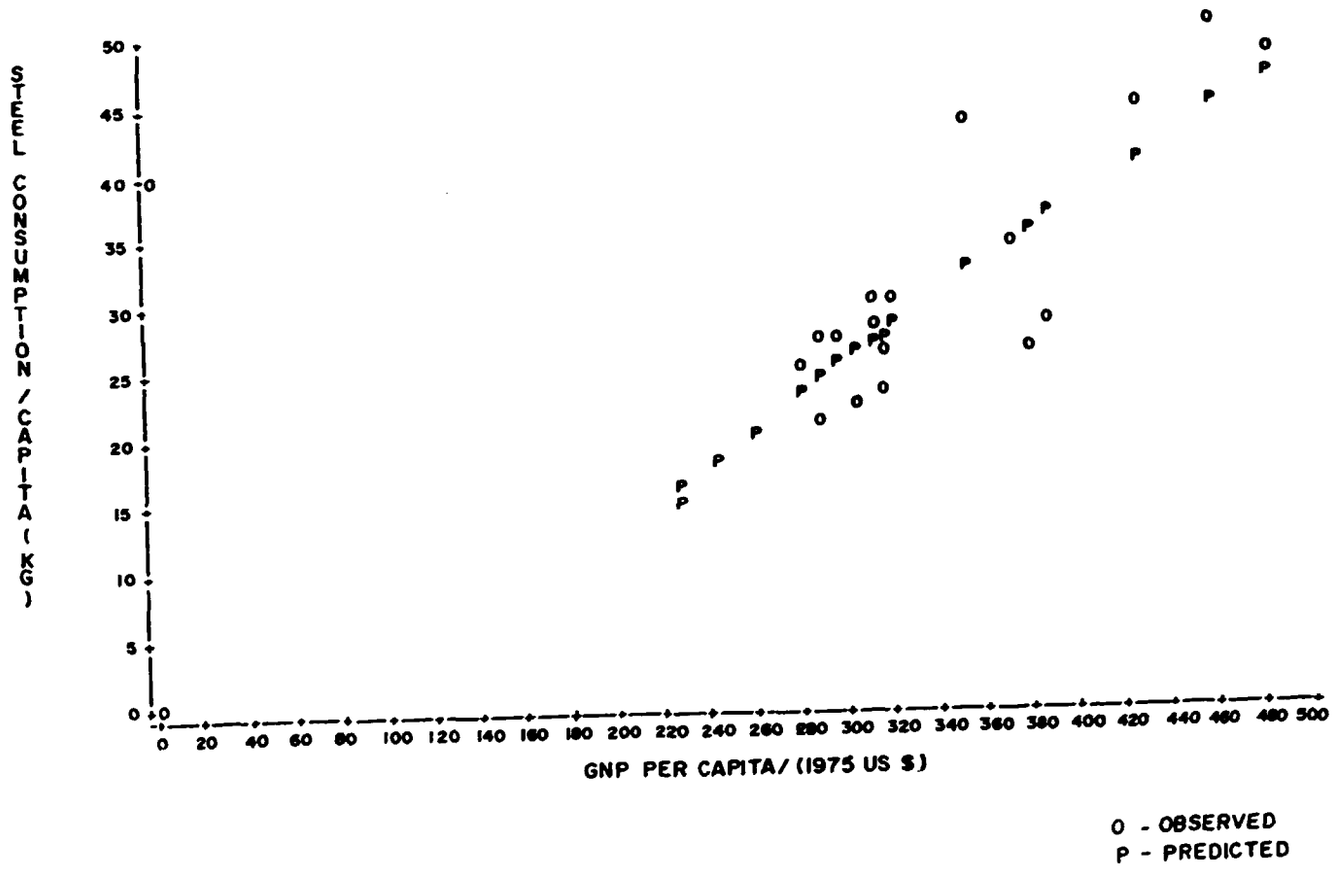
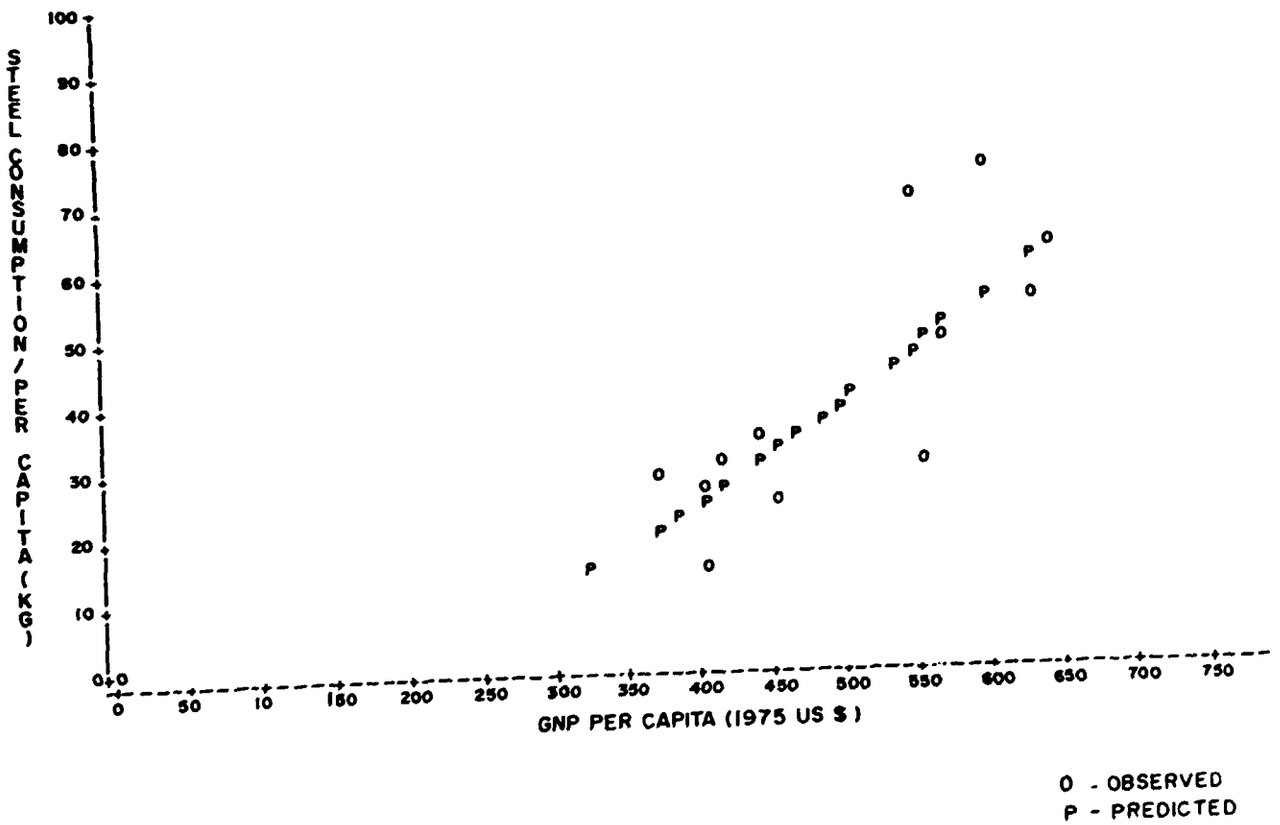


Figure 4

Jordan

MODEL = LNCPCP = A + B (INYPC) : LOG - INVERSE
AFRICA AND WEST ASIA = 400



D. Consumption of rolled products in Arab countries

The estimation made by the Arab Iron and Steel Union for the Arab world shows that total apparent consumption of reinforcing bars, wire rods, segments and flat products reached 10.5 million tons in 1983. In comparison with 1974, this is an important increase which represents 5.5 million tonnes, i.e., 52 per cent.

Currently, reinforcing bars and wire rods are in huge demand in the Arab world, representing 60 per cent of total rolled products consumed in 1974 and 55 per cent in 1983; then come the flat products (with 24 per cent in 1974, and 31 per cent in 1983) and finally sections (10 per cent in 1974 and 14 per cent in 1983).1/

The consumption/production gap represented, in 1983, 1.7 million tons of reinforcing bars and wire rods, 0.423 million tonnes of flat products and 0.76 million tons of sections. The local production is still low as it reached 29 per cent in 1983, for reinforcing bars and wire rods, 11 per cent for sections, and 42 per cent of flat products, which makes the Arab countries import considerable quantities of rolled products to meet their needs.

It is expected that the future total demand of reinforcing bars, wire rods, sections and flat products will reach 20.6 million tons in 1990 and 32.6 million tons in 2000. This forecast for the future was made by AISU based on historical analogy in the consumption of the years 1974-1983.

Sometimes the demand level differs to a great extent from country to country. It is expected that four countries (Algeria, Egypt, Iraq and Saudi Arabia) will reach more than 55 per cent of the future total demand for rolled products in 2000. As regards the share of these rolled products, in the future demand, it is expected that there will not be any radical change, and that the ratio of every product will be as follows:

	1983	1990	2000
Reinforcing bars and wire rods	55%	52%	51%
Flat products	31%	26%	29%
Sections	14%	22%	20%

E. Interregional trade in the ESCWA region

Qatar and Kuwait have been able to fulfil their local needs in steel bars for Qatar, and pipes for Kuwait. Surplus production has been exported to neighbouring countries. According to the Kuwaiti Company for Metallic Pipe, the only products in this field which are exported by Kuwait are spiral welded steel tubes and a small quantity of wire products.2/ The following table shows that both Qatar and Kuwait have been exporting to the region since 1982 (see tables II.3.6 and II.3.7)

1/ The AISU General secretariat, The Paper on rolling mills symposium, Damascus, June July 1985. Arab Steel (Acier Arabe), No. 133, June 1985.

2/ See Gulf Organization for Industrial Consulting, Strategic Plan for Developing Iron and Steel Industry in the Arab Gulf Region, vol. 3, 1985.

Table II.3.6. Qatar production and exports of concrete reinforcing steel bars (in thousand tons)

Year	Production	Exports	Exports/production percentage
1978	86	85.1	98
1979	380	330.6	87
1980	440	400.7	91
1981	453	416.8	92
1982	484.6	402.3	83

Source: Qatar Annual Statistical Year Book - 1983.

Table II.3.7. Kuwait production and exports of metal pipe industries (in thousand tons)

Year	Production	Exports	Exports/production percentage
1977	38,550	11,327	29.3
1978	26,492	2,994	11.3
1979	10,252	541	5.2
1980	29,878	-	-
1981	21,100	15,163	71.8

Source: Kuwait Annual Statistical Year Book - 1982.

The total steel exports from Qatar were 400700 tonnes in 1980. Saudi Arabia, the United Arab Emirates and Iraq are the major importers of Qatar's steel. Total export to these countries amounted to 83 per cent in 1980 and 98 per cent in 1982 (see table II.3.8).

Table II.3.8. Qatar exports to the Arab countries

	1979		1980		1981		1982	
	tons	%	tons	%	tons	%	tons	%
Saudi Arabia	196,624	59.5	175,841	43.9	208,815	50.1	212,550	52.8
Kuwait	74,655	22.6	58,166	14.6	3,808	0.9	5,084	1.3
U.A.E.	51,852	15.7	106,451	26.6	123,140	29.5	87,388	21.7
Bahrain	2,264	0.7	6,338	1.6	2,361	0.6	-	-
Oman	3,409	1.0	1,282	0.3	4,249	1.0	-	-
Iraq	1,767	0.5	52,063	13.0	74,444	17.9	97,323	24.2
Total	330,571	100.0	400,141	100.0	416,817	100.0	402,345	100.0

Source: Gulf Organization for Industrial Consulting, Strategic Plan for Developing the Iron and Steel Industry in the Arab Gulf Region, vol. 3, 1985.

F. Comparison of selected demand projections

In order to make a forecast for the years 1985, 1990 and 2000 of demand by the member countries of ESCWA, it is necessary to rely on a model. It could be a very simple one, giving the variable to be forecasted as a function of time only and then the forecast would be obtained from a trend extrapolation.

However, a more complicated model that describes the process that determines the variables by way of a behavioural relation and facilities has to be available. There is not a unique model which can describe steel consumption in the right way and which is therefore natural to use for prediction purposes.

Prospective demand estimated by the ESCWA secretariat for the region is based on the use of the method of historical analogy and regression analysis along with expert judgement supported by UNIDO projection figures.

The results of the estimations of long-term prospective demand and annual growth rates for the ESCWA region are presented in table II.3.9.

The growth rate of 6.2 per cent for the period 1985-1990 and 3.0 per cent for 1990-2000 were chosen as the most reliable rates of growth for extrapolation making a total of 16 MTPY in 1990 and 21.8 MTPY in 2000.

Table II.3.9. Long-term prospective demand and annual growth rates estimated for the ESCWA region - in thousand tonnes

	1980	1985	1990	2000
ESCWA	10,915.6	11,200	16,335	21,800
UNIDO	10,393.6	12,998.2	15,685	22,605
AISU	5,432.5	9,715	13,174	20,280

Annual growth rates of demand

	1980-1985	1985-1990	1990-2000
ESCWA	2.1	6.2	3.0
UNIDO	4.6	3.8	3.6
AISU	12.3	6.2	4.4

Source: Estimated by the Joint ESCWA/UNIDO Industry Division.

Typically, iron and steel forecasts have been based on variants of a per capita steel intensified paradigm which relates per capita steel consumption to some measure of component value added. This paradigm was inappropriate for the region due to the disproportionate share of regional GDP generated by the petroleum sector. The estimations made by UNIDO staff are based on the method where for each product, derived demand functions by the construction sector and by the manufacturing sector were econometrically estimated based on input-output production technology. The sources of data which were used in the forecast include the UNSO (United Nations Statistical Office) trade data base, the IISI publications - "Steel Statistics of Developing Countries", 1985, and the UNIDO data-base of country and regional input-output tables.1/

The future demand estimated by AISU is based on the historical consumption during the past years 1974-1983 taking into account the social and economic features of every country so as to be as realistic as possible, despite the fact that some figures existing in the Iron and Steel Arab Union Studies seem to be relatively modest.2/

Taking into account the expectation that the construction boom will be over in the oil-producing countries in 5-7 years, the conservative estimation made by the ESCWA secretariat and AISU seems to be more appropriate for the year 2000. Nevertheless, the tentative conservative forecast of demand made by UNIDO for 1990 and 2000 for the ESCWA region, comprising all countries of the region and the basic types of the consumed products, seems more realistic.

1/ See UNIDO. Tentative Projections of Steel Demand in the ESCWA Region. Sectoral Studies Branch, Division for Industrial Studies. Vienna. 28 October 1985.

2/ See Arab Steel (Acier Arabe), No. 133, June 1985, p. 67.

According to UNIDO estimations, the demand of steel products for the region will amount to 15,685 MTPY in 1990 and 22,605 MTPY in 2000, with a percentage ratio of the consumed products as follows: (see table II.3.10)

Table II.3.10. Demand forecast for the ESCWA region

(Thousand tonnes)

	1990	2000
Tubes, pipes and fittings	2841.73 (18%)	3808.46 (18%)
Angles, shapes and sections	1900.42 (12%)	2883.72 (12%)
Bars and rods	8194.75 (52%)	11325.65 (50%)
Universals, plates and sheets	2748.49 (18%)	4587.20 (20%)
Total	15685.39 (100%)	22605.03 (100%)

Source: Estimated by the Joint ESCWA/UNIDO Industry Division.

The region's demand will have to be met, both with regard to locally manufactured products and the imported ones. In conjunction with this, new industrial capacities in iron and steel will have to be installed in the region. The aspects of additional capacities required and material inputs required for the capacities projected is considered in the fourth chapter of the study.

Chapter III

PRESENT STATUS, STRUCTURE AND PROBLEMS OF THE IRON AND STEEL INDUSTRY

A. Background, present status and structure of the iron and steel industry in the region

In spite of the fact that the iron and steel industry in the Arab world consists of a number of modern iron and steel manufacturing plants, over 60 per cent of Arab steel is produced with the use of the traditional blast furnaces at the Helwan complex in Egypt (1,500,000 TPY), the El-Formulada complex (175,000 TPY) in Tunisia and the El-Hadjar complex (1,400,000 TPY) in Algeria. The following table shows the installed capacity of sponge iron, pig iron and molten steel.

Table III.1.1. Installed capacity of sponge iron, pig iron and molten steel in the Arab world in 1982

	Annual capacity (thousand tonnes)
Blast furnaces	3780
Direct reduction	800
Electric furnaces	1578
Oxygen converters	2950
Open hearth furnaces	244
Rolling capacities	
Rebars	2879
Sections	865
Wire and welded mesh	160
Flat products (only Egypt and Algeria)	1355
Production of tubes	847

Source: Compiled by the Joint ESCWA/UNIDO Industry Division derived from the data available in AIDO and from AISU statistics and presented to the Second Arab Congress on Steel Industry held in Bahrain in 1982.

In 1985 the total finished product capacity in the Arab world was 7,792 MPTY, according to the Arab Iron and Steel Union, which has compiled some statistical information. Wire rods and rebars represent 51 per cent or 4.062 MTPY; then come sections and flat products with 2.835 MTPY and 0.705 MTPY, representing 37 and 10 per cent respectively.

As for seamless pipes, which are produced in the El-Hadjar complex in Algeria, they represent 100,000 tonnes, that is only 2 per cent of the current total production capacity.1/

1/ Arab Iron and Steel Union. General Secretariat. AISU paper on Rolling Mills Symposium, Damascus, June-July 1985.

The effective production in the Arab world of sections and flat products attained 3,208 million tonnes in 1983, of which rebars alone were 1.662 million tonnes or 52 per cent, while flat products and sections reached 1.39 million tonnes and 0.155 million tonnes, representing 44 and 4 per cent respectively.

With the high investment required and the energy needed, the indigenous market opportunities make the ESCWA region an ideal place to locate steelmaking plants. Nowadays, about 60 per cent of total Arab iron and steel output has concentrated in the ESCWA region but the lack of diversity of this output remains a problem affecting economic integration and commercial exchanges among the Arab countries. For instance, cold and flat products as well as special steel products are manufactured in Egypt only. Seamless tubes are not produced in the region so far, and the total output of these products is concentrated in Algeria. Meanwhile the long products (reinforcing bars and sections) are manufactured by almost all countries of the region. These products accounted for 68 per cent of the total finished products manufactured in the region in 1983. Egypt remains a leading producer of the region (see table 7, annex I).

The first fully integrated unit was built in the region in 1956 (Egypt). At the beginning of the 1970s a rolling mill was established in Syria, but the dominant position in this field belongs to the Arab Gulf area. At present, the area includes six rolling mills with a total capacity of around 2 million tonnes per year.

The Qatar Iron and Steel Company (QASCO), with a capacity to produce 400,000 TPY of reinforcing bars, was established in 1974 and started production in 1978 as the first integrated iron and steel plant in the Gulf region. QASCO was soon to be followed by the Iraqi Steel Complex at Khor Al-Zubair near Basrah, and the 400,000 TPY mini-steel works of Khor Al-Zubair commenced production in 1979. Its production capacity was very much similar to that of QASCO. In December 1982 production started in the Saudi Iron and Steel company (HADED), at Al-Jubail with a capacity of about 800,000 TPY. It contains a reinforcing bar mill of a capacity of 530,000 TPY and a wire rod mill with a capacity of 270,000 TPY. This DR-base company plans to raise capacity by 200,000 TPY to 1 million TPY.

These three steel plants represent the second generation of steel mills in the Arab Gulf area. Their capacities were generally around 10 times the capacities of the first generation and they were all integrated plants. There was one similarity with the first generation plants, both produced only reinforcing bars. The combined rolling capacity of existing plants in the Arab Gulf area is about 1.8 million tonnes. This is distributed over three integrated plants, one semi-integrated plant, and four rolling mills. All existing plants produce only reinforcing steel as their final product, (see table III.1.2).

Table III.1.2. Existing and planned rolling capacity in the ESCWA region in 1984

(thousand tonnes/year)

Egypt (Egyptian Iron and Steel Co., Delta Steel Mill and Others)	-	1.880	
Syria (Gecosteel)	-	120	
Jordan (Arab Iron and Steel Industries Co., National Iron and Steel Co., Jordan Iron and Steel Co.)	-	396	
Total existing capacity		2396	
Rolling mill Project (Al Dekheila), Egypt		750	(Realization phase)
Existing and Planned Capacity		3146	
Gulf area			
Qatar Iron and Steel Plant		400	
Saudi Iron and Steel Plant		800	
Steel Rolling Mill, Jeddah		140	
Iraqi Steel Mill, Khor Al-Zubair		400	
Ahli Steel Mill, Dubai		20	
Small Mills in U.A.E.		40	
Total existing capacity in Gulf area		1.800	
Rolling Mill Project, Oman		200	(Promotion)
Existing and Planned Capacity		2.000	
Total existing and planned capacity in the ESCWA region		5.146	

Source: "The current situation in the field of rolling in the Arab world and the demand expectations for rolled steel products between 1990-2000". By the AISU General Secretariat. Arab Steel (Acier Arabe), No. 133, June 1985.

- Mr. Nabil El-Tayel, Future Gulf Rolling Mills, Papers of AISU Rolling Mills Symposium, Syria, 1985.

Available statistics show that actual production of rolled products in the ESCWA region is unbalanced and does not meet the internal market capacity. Sections and flat products amounted to only 766,400 tonnes in the major producers of the products in 1983.

Table III.1.3. Actual production and apparent consumption of some rolled products in the ESCWA region in 1983

(tonnes)

	Rebars and wires		Sections		Flat products		Total	
	Production	Consumption	Production	Consumption	Production	Consumption	Production	Consumption
Egypt	183,004	638,000	154,832	454,000	611,651	800,700	959,487	1,892,700
Jordan	115,000	230,000	-	27,000	-	62,000	115,000	319,000
Iraq	21,132 a/	196,000	19,164 a/	87,000	-	85,000	40,296 a/	368,000
Saudi Arabia	380,000	1850,000	-	210,000	-	503,000	380,000	2,563,000
Qatar	460,000	86,000	-	5,500	-	21,000	460,000	112,500
Syria	84,137	128,500	-	53,500	-	76,000	84,137	258,000
U.A.E.	32,000 b/	210,000	-	45,000	-	153,000	32,000 b/	408,000
Lebanon	-	205,000	-	26,000	-	92,000	-	323,000
Kuwait	-	312,000	-	30,000	-	135,000	-	477,000
Bahrain	-	42,000	-	9,000	-	11,000	-	62,000
Oman	-	56,000	-	-	-	13,000	-	69,000
Yemen Arab Republic	...	...	...	...	...	...	...	...
People's Democratic Republic of Yemen	...	16,600	...	...	...	...	...	16,600
Total	1,222,141	3,970,100	154,832	947,000	611,651	1,951,700	1,998,624	6,868,800

Source: Compiled by the Joint ESCWA/UNIDO Industry Division derived from Arab Steel (Acier Arabe), No. 133, June 1985.

a/ 1981.

b/ 1982.

In spite of the fact that the total apparent consumption of rebars, wire rods, sections and flat products reached around 6.8 million tonnes in 1983, the local production in 1983 was only 30 per cent of total consumption for rebars and wire rods, 16 per cent for sections and 31 per cent for flat products. The rest obviously had to be imported. (see table III.1.3)

B. Characteristics of the existing and planned capacities in the region

The national programmes for developing iron and steel industries in the countries of the region have high priority within the industrial plans of all countries of the region. The following pages show the existing plants, their capacities, the nature of these factories and the range of products produced.

1. Egypt

Egypt has the distinction of being the first in the Arab world to have a steel plant as far back as 1947, now managed by the Delta Steel Company. Its only integrated plant is at Helwan.

Delta Steel Company

The facilities consist of an old steel melting shop (1948) with a 12-ton and a 18-ton electric arc furnace. A new steel melting shop comprising two 25-ton electric arc furnaces (1975 and 1984) and a continuous caster casting 130 sq mm blooms have been built.

Delta management holds the view that instead of setting up new plants, production in the existing plants should be optimized and the maximum outputs realized. Delta's aim is to reach 200,000 TPY by introducing new technology in steel melting and rolling practices almost double the present output.

The Egyptian Iron and Steel Company

The Egyptian Iron and Steel Company was established in 1954 and opened the first iron and steel working in the Helwan area; this 1.5 million per year integrated works is a State-owned enterprise. It depended mainly on the exploitation of the iron ore found in the East Aswan area. Products include plate, sheet, hot and cold strip, sections, rod and bar, tinplate and galvanized sheet:

Flats 8-12 x 40 mm

Channels 80-260 mm

Rounds 50-125 mm

Rails 18, 37, 52 kg/m

Equal and unequal angles 70-150 mm

Beams 100-260 mm

Squares 50-300 mm

In addition, products include reinforcement bars and wire rods 6-32 mm dia., angles (small sections) 30-50 mm, plates 4-25 mm thick/1500 mm wide, Hot rolled sheets and coils 1-7 mm thick x 600-100 mm wide, Cold rolled sheets and coils 0.2-2.5 mm thick x 900 mm wide, tinplate (hot dip) 0.2-0.32 mm x 608-530 mm wide x 712-760 long.

One of the problems facing the operation of the plant appears to be associated with the quality of the ore feed, and in this context it is planned to carry out a benefication research programme aimed eventually at improving the productivity of the ovens and decreasing the consumption of coke. The works is currently the subject of a $US 100 million modernization and rehabilitation programme.

National Metal Industries Company

This plant produces 70,000 TPY of rebars 6-28 mm dia and TORSTEEL with semi-integrated facilities comprising two 35-ton open-hearth furnaces and two bar mills. A new expansion project is being implemented with the aid of the United States of America, comprising new electric furnaces and a continuous caster. The total production will then increase to 220,000 TPY, of which one mill will produce 80,000 TPY and the other one 140,000 TPY.

The Egyptian Copper Works Company

A semi-integrated plant which has a possible production capacity of 200,000 tonnes of steel per year and includes: three open-hearth furnaces, capacities 30-35 (72,000 TPY) and 50 tonnes; one 25-ton electric furnace (45,000 TPY); one bar mill, capacity 70,000 to 72,000 TPY; one steel roll foundry, capacity 4,000 TPY; one wire rope shop, capacity 1,500 TPY; one steel foundry, capacity 10,000 TPY and one mill for baling hoops, capacity 8,000 TPY.

El-Naser Pipe Manufacturing Company

Started production in 1962, it has the following:

- Line for longitudinally welded pipes 0,5" to 4" diameter, with a capacity 10,000 TPY;
- Lines for spirally welded pipes 6" - 24" diameter;
- One foundry for pearlitic and malleable iron fittings.

In 1979, the company opened the pipe manufacturing plant, which has a production capacity of 30,000 TPY of 30 inch pipes to be exported to Arab oil countries.

Future development

The steel industry in Egypt has an ambitious plan of attaining 15 MTPY by A.D. 2000. According to the Helwan, the Egyptian iron and steel capacity is as follows:

Company	Capacity (MPTY)
Helwan integrated plant (now producing barely 0.8 MTPY owing to bottlenecks, but hope to reach 1.2 MTPY in 1987) making use of loans from the World Bank and KFW, Federal Republic of Germany. By 1990, they hope to expand to 2 MTPY	1.20
Delta Steel Company (has a contract with Ferrostaal, Federal Republic of Germany to increase to 0.4 MTPY)	0.09
National Metal Industries Company (plans to increase to 0.30 MTPY)	0.18
Egyptian Copper Works, Alexandria (plans to increase to 0.225 MTPY)	0.07
National Iron and Steel Co., Alexandria (new DR-based plant under construction scheduled to start in June 1986)	0.82
Other firms	0.30
Total	2.66

Bahrain

Bahrain authorized in 1978 the construction of a scrap melting plant to produce reinforcement bars. In 1980, the Arab Iron and Steel Company (AISCO) installed a pelletization plant in Bahrain (as a joint project with participation of the Arab Mining Company) in order to ensure a supply of pellets for the region. At present three factories for iron and steel (Qatar, Saudi Arabia and Iraq) in the Gulf area imports pellets for their direct reduction process from other countries.

This pelletizing plant will comprise the following units:

- Iron ore drying and grinding unit;
- Blending and pre-wetting unit;
- Baling unit;
- Indurating unit;
- Product stock piling, reclaiming and loading-out unit;
- Waste reclamation unit.

Inaugurated at the end of 1984, the plant has run into technical problems and has stopped production. The authorities said that in addition to

the technical problems at the 4 mt/year pellet plant, the company is finding problems in selling the output. Stocking capacity of some 300,000 - 400,000 tonnes of pellets at the plant is almost full, and apart from a trial shipment of 20,000 tonnes to Saudi Arabia, no sales agreements have been concluded so far.1/

3. Iraq

Iraq at present has an iron and steel complex (Khor Al-Zubair) and two other plants for the production of pipes, iron and steel castings.

The iron and steel complex (Khor Al-Zubair)

The main iron and steel complex with a direct reduction plant to produce 400,000 TPY of sponge iron was initiated in the mid-1970s. Iron pellets used as an input for sponge iron production were planned to be imported mainly from Brazil and Sweden. Early in the 1980s, a semi-integrated plant with a production capacity of 400,000 tonnes of rolled iron was put into initial operation at Khor Al-Zubair complex. The product mix is as follows:

- 240,000 TPY of reinforcement bars;
- 160,000 TPY of hot sections.

It was planned that another steel factory with a design capacity of 1 million tonnes per year of DR-iron, and 1.25 MTPY EAF-steel to be put into operation in the mid-1980s, but construction of the plant has been postponed.

The steel pipe plant (Um Qasir, near Basrah)

Its production capacity is 20,000 tonnes for each working shift (has three shifts). Total production capacity is 60,000 tons /year. The produced pipes are used for local pipeline (oil and gas). The plant produces spirally welded pipes of diameters 219 to 1,219 mm with a thickness of 3.2 to 12.7 mm.

Iskandaria Mechanical Industries Company

To produce iron and steel castings with a capacity of 14,000 TPY, the Company is provided with four electric furnaces for the melting of cast iron and steel.

Future development

Iraq expects to increase its production of steel to reach in 1990 2.5 million tonnes, where they expect to cover their internal consumption of steel.

1/ Metal Bulletin, May 1985.

4. Jordan

The iron and steel plants in Jordan depend on import of pellets to produce reinforcement rods and welded pipes to meet the increasing local demand.

Jordan Iron and Steel Company

The Company was established in 1965 and started production in 1967. It is located at Zarqa-Awajan. The plant is equipped with a 12 t/hour arc furnace, a Danielli two-strand continuous casting machine and three multi-stand rolling mills. There is also a large annealing furnace.

The company also runs a small electric steel works at Zarqa, producing 50,000 TPY of bars with Jordan Pipes Manufacturing Co. (JPMC).

Jordan Pipe Manufacturing Company (JPMC)

Jordan Pipes Manufacturing Co. was established in 1973 at Zerka district. The company produces 12,000 TPY of small-diameter welded pipes. It has an expansion programme to produce 6 inch pipes.

National Steel Industry Co. Ltd.

It was established in 1979 at Zarqa-Awajan and has a capacity of 120,000 TPY of finished products. It is equipped with rolling mills to produce reinforcing bars, round bars and light angles.

Arab Engineering Industries Company

The Company was established in 1984 for setting up factories for metal castings and other products used in industrial, agricultural and building activities, as well as to import, store, trade and export such products. It has been entrusted with setting up a grey iron foundry with an initial capacity of 10,000 TPY and to reach 16,700 TPY.

The project is estimated to cost JD 20 million ($US 50 million). Seventy per cent of the equity will be provided by the Pan Arab Mining Company, the Arab Industrial Investment Company (Baghdad), the Pension Fund and the Social Security Corporation. The remaining 30 per cent will be provided by banks and other institutions. Commercial production is expected to start in March 1988.

5. Kuwait

A 116,000 TPY pipe plant which produces 100,000 TPY of spiral welded pipes and 16,000 TPY of galvanized pipes, was built in 1967 in the Shoueikh region in Kuwait. The plant includes:

- 6 production lines of spiral welded steel pipes;
- 4 lines of large diameter pipes;
- 2 lines of small diameter pipes.

Kuwait plans to build a 100,000 TPY bar rolling mill for domestic consumption needs, which reached around 270,000 tonnes in 1978 and 312,000 tonnes in 1983.

6. Oman

The Oman State so far plans installing an iron and steel plant which will have a production capacity of 400,000 TPY of sponge iron of which 150,000 tonnes are intended for production of 120,000 TPY of bars, 30,000 TPY of angles and sections and the rest for export as sponge iron.

7. Lebanon

In Lebanon there are two rolling mills, with total capacity of 240,000 TPY using imported pellets and two pipe-plants with a capacity of 79,000 TPY and 12,000 TPY. The production output is limited to the production of concrete reinforcement bars, pipes, cable metal sheathing wires and cables, wires or strips of iron. An installation at a new steelmaking plant is planned.

8. Qatar

Iron and steel production in Qatar started in 1978 under the Qatar Iron and Steel Company (QASCO), with a capacity of 400,000 tonnes, to produce 360,000 tonnes of rolled iron plus 20,000 tonnes of square billets for export purposes.

QASCO was the first DR-based steel work established in the Gulf region. Its 400,000 TPY Midrex plant at Doha serves two 70-tonnes electric arc furnaces with a capacity of 207,000 TPY each.

The iron feed requirements for this company were estimated at 60,000 tonnes a year of pellets and 100,000 tons/year of scrap which is to be imported from Australia and the United States.

The principal raw material used are iron ore pellets and steel scrap, occasionally supplemented by lump ore. Present supply sources are Brazil and Sweden, though other sources such as Australia and India are under study. Steel scrap is obtained mainly from the United States supplemented by small quantities from Kuwait and Qatar itself.

QASCO has been marked by some impressive technical and production successes and is currently running at over 140 per cent of its rated capacity (330,000 TPY). The past production was as follows:

1983 - 475,000 tonnes
1984 - 467,000 tonnes
1985 - 477,000 tonnes (estimated).

9. Saudi Arabia

At present, the main projects in operation in the iron and steel industry are:

Steel rods factory - Jeddah (Jeddah Steel Rolling Mill Co.)

The factory was founded in 1966 to produce iron rods. After expanding the plant, the maximum production capacity reached 15,000 tons. Studies are under way aimed at modernizing and expanding the factory so that its production capacity would reach 140,000 tonnes. Imported pellets were used until the Jubail complex started its production in 1983. The expansion plans include two units:

(a) Rolling mill with the capacity of 90,000 tonnes of reinforcement bars, 14-28 mm in diameter;

(b) Wires/cables unit with a design capacity of 50,000 tons. The expansion plans were finished in 1981. Two other projects are under construction.

The Iron and Steel Complex of Jubail (Saudi Iron and Steel Co.)

The building of an integrated 850,000 TPY plant was initiated in 1979 and production was started in 1983. The method of production is by direct reduction using the Midrex process based on pellets of imported high grade ore. Consumption of imported iron pellets is approximately 1 million TPY. The preliminary design capacity for the first stage is 800,000 TPY of rolled steel. The charge used in the plant consists of sponge iron (80 per cent) and scrap (20 per cent). The plans have taken into consideration the possibilities of future expansion, to reach a capacity of 3.5 to 4 million tons of rolled steel by 1989.

The complex was erected in two stages; the first stage consists of:

- Two direct reduction units with a capacity of 800,000 TPY of sponge iron. (two 400,000 DR-module);
- Three electrical furnaces each with a batch capacity of 129 tons;
- A continuous casting unit with a production capacity of 800,000 TPY;
- Two independent rolling mills, one for the production of reinforcing bars with a capacity of 500,000 TPY and one for the production of wire rods with a capacity of 270,000 TPY.

The output includes various rolled steel, like bars, wires, plates and corners.

Welded Pipe Plant, Dammam (National Pipe Co. Ltd.)

Construction of the plant started in 1978, and was completed in 1979. It produces large diameter 20-60 inch, spirally welded pipes. The designed production capacity is 80,000 TPY.

In spite of good potential for developing the iron and steel industry, Saudi Arabia remained an importer of finished steel products. Its annual share in the total region's import of the product is around 40 per cent.

10. Syria

Syria has three steel plants located at Hama, about 250 km to the north of Damascus. These plants are:

(i) A steel rolling mill started in 1972 with an initial capacity of 75,000 TPY of 8-18 mm diameter rebars and rounds, increased subsequently to 120,000 TPY. This is a semi-integrated plant with two 30-ton electric furnaces and a rod mill. The full output is presently consumed in Syria.

(ii) A steel scrap foundry with electric arc furnaces to melt imported and local scrap to continuously cast and produce pellets as feedstock for the above mill, started with technical assistance from the Federal Republic of Germany (Brown Boveri and Contast) is 120,000 TPY of pellets.

(iii) A welded steel pipe mill, using an electric induction welding process to produce 20,000 TPY of 3/8" - 3" diameter, black and galvanized pipes from imported coils for water and other commercial uses was set up with technical assistance from Demag, Federal Republic of Germany. Actual production commenced in 1978. Hama GE-COSTEEL is the only steel complex in Syria and expansion plans to increase the capacity of the rolling mill to 240,000 TPY are included in the next five-year plan (1986-1990).

11. United Arab Emirates

There are three operational iron and steel plants and some other projects under study.

Abu Dhabi Iron Plant

The plant started production in 1977. It is a public sector factory (rolling mill) with a production capacity of 20,000-25,000 TPY on the basis of two work shifts per day. It was designed to produce reinforcement bars and sections.

Dubai Steel Plant (Ahli Steel Co.)

A private sector factory with a semi-mechanized plant uses scrap metal to produce reinforcement bars. The plant started production in 1976; it had some market problems and closed in 1977. It was reopened for production in July 1978. Ahli Steel Co. runs a 12-tonne electric furnace in the Rashidiyaa industrial area at Dubai with 2-strand continuous pellet casters and a 10 tph mill producing 36,000 TPY of 10-32 mm rebars. Design capacity of the plant is 36,000 TPY, but the actual production has not reached more than 24,000 TPY, because of the low quality of scrap metal used, which is also not available on a regular basis.

The Ras Al-Khaima Iron Mill

The plant was established in 1975 and belongs to the private sector. It produces reinforcement rods using scrap metal and its design capacity is 50,000 TPY, but presently operated capacity is only 20,000 TPY. In addition

to these plants there is the Dubai Iron Company, which started production in 1969 but closed in 1975. It had a design capacity of 25,000 tons to produce reinforcement bars.

Future development

The other projects which are still under study are:

(a) Abu Dhabi Iron and Steel Complex - capacity of 1 million TPY;

(b) Iron and Steel Factory for Dubai - capacity of 70,000 TPY;

(c) Steel pipes factory - capacity of 40,000 TPY.

From the above it is clear that almost all existing plants in the region are suffering from underutilization of installed capacity and market limitation.

The problems which are facing the iron and steel industry of the region may be summarized as follows:

- Lack of diversity of output, which affects economic integration and commercial exchanges among countries of the region;

- Poor links of the iron and steel sector with other sectors, the links of the industry with the construction sector are stronger than with the capital goods industry;

- Weak dispersion of supporting services throughout the region surrounding the steel plants and lack of general spare parts;

- Insufficiency of skilled personnel, workers drain, and inadequate transport communications;

- Inadequacy of raw materials to necessary specifications which takes place in some cases.

First of all, solution of these problems should be taken into account before setting up additional units. In this respect, the specific conditions of each country of the region in terms of natural resources, level of production of iron and steel and capital goods, their interrelations, as well as technological developments already achieved, should be taken into accoun in planning both new and additional capacities.

C. Size and scale economies

The restructuring process taking place at the world-wide level has reduced total world demand for steel and it has also altered the structure of the iron and steel industry. Presently, both developed and developing countries are seeking ways of being more competitive by introducing innovations such as continuous casting and the so-called "mini-steel plant" concept involving the use of electric arc furnaces and producing steel of different qualities.

According to some UNIDO studies, the main motivating factors determining the establishment and location of mini-steel plants in both developing and developed countries was the domestic demand. That aspect was true of 82 per cent of all plants studied and of 93 per cent of them in developing countries. The second most important factor was the availability of raw materials, which was proved by the location of 45 per cent of plants in both developing and developed countries. Some other factors were the availability of infrastructure, energy, skilled labour and financial resources.1/

There are different views on defining a mini-steel plant in terms of its size. This size may not always be very material, as it would depend entirely on the economies of each case which, in turn, is affected by the market situation, raw material availability, cost of input like coal, gas, iron ore, scrap, power etc. Mini-steel plants in the developed countries generally have capacities of 100,000 tons per year and above. For developing countries sizes are much smaller (for example, India has electric arc furnaces as mini-steel plants with capacities of only 10,000 to 20,000 TPY).

The mini-steel plants have some distinct advantages over the conventional integrated steel works, e.g.:

- Lower investment cost;

- Easier operations as a result of fewer, simpler production units.

The investment cost of installed capacity may vary greatly between regions and countries. According to UNIDO's research the investment cost per tonne of installed capacity of a mini-steel plant is about 40 per cent of BF/BOF cost when only scrap is charged and 60 per cent if a direct reduction unit is included.2/

Owing to the process of inflation at the world-wide level which began during the mid-1960s, the cost of a tonne of steel capacity has increased

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1/ See: (a) The mastering of the technology and development of the iron and steel industry in developing countries. UNIDO (ID/WG.458/12) 21 February 1986, prepared for the Fourth Consultation on the Iron and Steel Industry;

(b) Shree N. Acharya (UNIDO consultant). Mini Steel Industry (ID/WG.363/1) 12 January 1982, prepared for the Second Working Group Meeting on Scenarios of the Iron and Steel Industry's Development;

(c) Optimum scale production in developing countries: a preliminary review of prospects and potentialities in industrial sectors. Sectoral Studies Series No. 12 (UNIDO/IS, 471) 12 June 1984.

2/ Shree N. Acharya (UNIDO consultant). Mini-Steel Industry (ID/WG.363/1) 12 January 1982, prepared for the Second Working Group Meeting on Scenarios of the Iron and Steel Industry's Development.

rapidly. In 1975 the average cost of a tonne of installed capacity of new classical integrated iron and steel plant was about $US 800. At the beginning of the 1980s this index accounted for about $US 1,700. In the case of mini-plants based on direct reduction or an electric arc furnace, it was, on average, approximately $US 1,000. In the analysis of the ongoing new projects, the cost of expansion of existing capacity varied from $US 300 to $US 1,000 and in the case of new planned capacities of an integrated plant the cost varied between regions and countries from $US 1,000 to $US 6,000.1/

It can be seen from the above figures that the scale economies obtained in respect of the mini-steel plants with an electric arc and the classical route (blast furnace + oxygen steelmaking) are very considerable. By contrast, the scale economies are considerably less substantial in the direct reduction/electric furnace route. To obtain capacities of more than 400,000 TPY, it has until recently been necessary to juxtapose at least several direct reduction modules and several electric furnaces.

For the Arab countries with rich oil and natural gas resources the route of sponge iron production by direct reduction using natural gas and steel production by an electric arc furnace is, in general, most appropriate and economical, taking into account that the cost of electric power, scrap and natural gas and electrodes may account for about 25 per cent of the final pellet cost estimate. (As compared with this, in the BF/BOF process, coke plus oxygen and electricity represent about 35 per cent of the final pellet cost.)

It is not easy to calculate correctly how costs vary with the scale of operations, because changes in volume produce different effects at successive stages of steelmaking. No single mathematical formula, therefore, would serve to calculate even approximately the investment and production costs of all integrated steel plants. In order to determine the influence of size on costs in the steel industry, it is necessary to prepare complete projects for hypothetical plants of different sizes and to calculate in each case the investment and production costs.

The discussion of economies of scale demonstrates the need for a sufficiently large market to operate a plant of minimum economic size even allowing for use of the alternative technology, mainly the DR-method. In the ESCWA region the iron and steel designed capacities established varied from 20,000 TPY to 1.5 million TPY (see table III.3.1).

The percentage share of the "all kind" works with installed capacities from 20 MTPY to 100 MTPY accounted for 20 per cent; over 100 MTPY to 600 MTPY - accounted for 64 per cent; and over 600 MTPY is only 10 per cent of "all kind" installed capacities in the region. The latter refers to the Egyptian plant following the conversional steel production process. A modern mill may have a capacity of 1 to 4 million tonnes. The next bigger sized capacity integrated steel plants are expected to be established in Iraq and Qatar, both adopting the DR-process.

1/ Financial Situation and Perspective of the Iron and Steel Industry. UNIDO (ID/WG.458/13) 21 February 1986. Prepared by the UNIDO secretariat for the Fourth Consultation on the Iron and Steel Industry.

It is to be noted that scale economy should be evaluated in overall content and not only in terms of costs per installed tonne, since the viability of a large unit involves higher investments and requires a larger market, more developed upstream and downstream industrial structures, efficiency of management and maintenance.

Table III.3.1 Total installed capacities in the Arab world
(as 1 January 1982)

(000 tonnes)

	Iron Production		Steel production			Rolled Production						Pipes	
						Rebars	Sections		Plats		Wire		
	B.F	D.R	Converter	E.A.F.	O.H		Hot	Cold	Hot	Cold		W.P	S.P
Egypt	1750	-	1500	210	214	461	565	40	575	260	30	30	-
Syria	-	-	-	130	-	120	-	-	-	-	-	20	-
Jordan	-	-	-	30	-	135	-	-	-	-	-	30	-
Iraq	-	400	-	500	-	240	160	-	-	-	-	55	-
Kuwait	-	-	-	-	-	-	-	-	-	-	-	116	-
Saudi Arabia	-	-	-	-	-	140	-	-	-	-	-	-	-
Qatar	-	400	-	416	-	330	-	-	-	-	-	-	-
U.A.E.	-	-	-	110	-	147	-	-	-	-	-	-	-
Lebanon	-	-	-	-	-	330	-	-	-	-	-	90	-
Total ESCWA region	1750	800	1500	1396	214	1903	725	40	575	260	30	341	-
Algeria	1880	-	1300	120	30	620	20	80	400	120	110	270	96
Tunisia	150	-	150	30	-	180	-	-	-	-	20	-	-
Libyan Arab Jamahiriya	-	-	-	20	-	60	-	-	-	-	-	120	-
Mauritania	-	-	-	12	-	36	-	-	-	-	-	-	-
Morocco	-	-	-	-	-	35	-	-	-	-	-	-	-
Sudan	-	-	-	-	-	45	-	-	-	-	-	20	-
Total Arab world	3780	800	2950	1578	244	2879	745	120	975	380	160	751	96
ESCWA region as a % of total Arab world	46.0	100.0	51.0	88.0	88.0	66.0	97.0	33.0	59.0	68.0	19.0	45.0	-

Source: Compiled by the joint ESCWA/UNIDO Industry Division derived from the data available in AIDO and from AISU statistics, presented to the Second Arab Congress on the Steel Industry held in Bahrain in 1982.

Abbreviation: B.F. - Blast furnaces; D.R. - Direct reduction;
E.A.F. - Electric arc furnaces; O.H. - Open hearth furnaces;
W.P. - Welded pipes; S.P. - Seamless pipes.

D. Capital investment and assessment of technology

The cost of an integrated steel plant in a developing country will clearly vary according to the technology and process adopted as well as the output capacity. The mastering of the technology depends, to a great extent, on the strategy of industrialization. It is most important to develop a strategy which promotes the integration of the iron and steel industry with the capital goods sector and other sectors of the economy, as well as co-operation at the regional and sub-regional levels.

Other factors which affect considerably the capital investment and cost of production are:

- Type of a steel plant;
- Quality of steel required to be produced;
- Cost of imported plant and equipment;
- Lack of adequate infrastructure;
- Availability of local trained and skilled labour;
- Timeliness of operations.

The delays in the development of a project have a serious impact on the total cost of the project, which could cause an increase of 1.5 per cent to 3 per cent per tonne, or between 18 to 36 per cent in a year. In turn, the cost of a project also has an important impact on the operational phase of the plant due to the fact that the amortization and the financial expenses represent more than 10 to 17 per cent of the cost of a tonne of installed capacity.1/

Based on the latest development in production technology of iron and steel, and resource base available in the region, the ESCWA countries should choose technologies and types of production which aid maximum co-operation and integration among themselves in order to achieve economy of scales and higher productivity.

DR/EAF steelmaking

As mentioned above, most of the theoretical studies which were prepared during the last few years confirm that the production cost in the integrated steel plants with a direct reduction, when using gas as a source of energy and reducing agent, is lower than the production cost of the classical route. During the conference held by the IISI Committee of Technology in 1979 in Rio de Janeiro, a comparison was made of the production cost of one ton of steel in the integrated plants with two different routes, viz., the blast furnace/oxygen convertor (the classical route) and the direct reduction (based on the HyL process)/electric furnace. The comparison was made on the following assumption.

(a) Productive capacity of direct reduction electric furnace is equal to 950,000 t/y and of blast furnace-oxygen converter 1 million tonnes/year;

1/ Financial situation and perspectives of the Iron and Steel Industry. (UNIDO ID/WG.458/13) 21 February 1986. Prepared by the UNIDO secretariat for the Fourth Consultation on the Iron and Steel Industry.

(b) Fixed costs are equal to 20 per cent of investments including amortization and capital opportunities;

(c) The cost of the investment on a coking plant plus blast furnace is $US 200 for each ton of liquid steel and for an oxygen converter is $US 85 for each ton of steel. As regards the investment cost for a direct reduction plant, it is $US 100 for each tonne of sponge iron and $US 80 for each tonne for an electric furnace.

The results of such a comparison are presented in table III.3.2. These results convincingly confirm the above in respect of advantage of steel production by the direct reduction/electric furnace route.

Table III.3.2. Production cost of one ton of steel in the integrated steel plants

Details	Measure Unit	Price $ for one unit	DR - Electric furnace 950,000 t year		Blast furnace oxygen converter million ton year	
Iron making			Number of units in 1 ton	Cost	Number of units in 1 ton	Cost
Pellets	tonne	32.50	1.34	43.61	1.45	47.13
Coke	tonne	81.60	-	-	0.45	40.58
Limestone	tonne	8.00	-	-	0.10	0.80
Natural gas		0.933	2.90	20.97	-	-
Cost of other operations		-	-	5.00	-	10.00
Fixed costs				20.00		40.00
Total of costs of sponge iron and hot metal				95.58		138.51
Steelmaking						
Sponge iron	tonne	95.58	0.94	89.85	-	-
Hot metal	tonne	138.51	-	-	0.90	124.66
Scrap	tonne	80.00	0.22	17.60	0.22	17.60
Labour	man hour	8.00	0.55	4.40	0.50	4.00
Oxygen		0.30	-	-	51.20	1.54
Electrical energy		0.02	620	12.40	-	-
Electrodes	kg	1.60	5.60	8.96	-	-
Refractories		-	-	3.70	-	1.00
Fluxes	kg	0.035	25	0.88	75	2.63
Maintenance		-	-	2.40	-	2.40
Others		-	-	3.50	-	3.50
Fixed costs		-	-	1.600	-	17.00
Cost of liquid steel	tonne	-	-	159.69	-	174.33
Economy of DR route		-	-	14.69	-	-
Electric furnace		-	-	-	-	-

Source: Arab Iron and Steel, November 1982.

Direct reduction combined with electric arc furnace steelmaking is ideally suited for ESCWA countries. Some advantages include: 1/

(a) Efficient use of natural gas resources.

(b) Independence from coke and scrap imports.

(c) Less water requirement than the BF/BOF route.

(d) Less demand on infrastructure and manpower than the BF/BOF route.

(e) Lower capital cost than the BF/BOF route.

(f) Shorter construction time than the BF/BOF route.

(g) Greater flexibility (and efficiency) in adjusting to fluctuations in steel market demand than the BF/BOF route.

(h) Capacity sized to market needs rather than economy-of-scale limitations.

(i) Capacity of meeting the most stringent steel specifications.

(j) Easier environmental control than the BF/BOF route.

Optional ways of domestic steel industry and DR/EAF steelmaking route

In establishing a domestic steel industry, there are two optional ways:

- First option is to select simple steel products, such as rebar, which has a high market volume and is relatively easy to produce.

- Second option is to select a high quality steel product such as seamless pipes which can be produced in low tonnage capacities which are high in demand in oil producing countries.

In the ESCWA region, these two types of products make up a dominant share of the total imported products. Assuming that part of the flat products are used in producing welded pipe, the actual product mix consumed is closer to 60 per cent non-flats, (rebar, rod, sections, rail bars), and 30 per cent pipes.

The high proportion of non-flats can be attributed to the vast construction taking place in these countries of the region and the emphasis on the use of steel and concrete in the regional construction industry.

The high proportion of pipes can be attributed to the predominance of

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1/ See J. Lepinski, A. Vallomy. The Direct Reduction/Electric Arc Furnace Steelmaking in the Arab Steel Industry. The documents of the Arab Iron and Steel Union Electric Arc Symposium, Doha, Qatar, 1981.

the oil industry in many countries of the region. Currently, there is only one semi-intregrated 85,000 TPY seamless pipe mill in Algeria.[1/]

Sixteen welded pipe mills with a combined capacity of 750,000 TPY are operating in the Arab countries, but the product from these mills is oriented towards different applications (e.g., water, gas, electrical systems, furniture manufacture), than those for seamless pipes.

Production of seamless pipes via the DR/EAF route offers an extra bonus for countries with low priced natural gas. The high quality steel produced via the DR/EAF route has good response to heat treatment. The production of seamless pipes in the region would fill a real need. In addition, the manufacture of this product in the region has several advantages[2/]:

- Since oil-producing Arab countries are currently the largest importers of seamless in the world, all the production can be sold in the area.

- The world-wide market for tubular steel products has been steady during the last decade and is expected to remain steady even during periods of low steel demand.

- Economic production of seamless pipes does not require large scale production capacity. The optimum plant size is between 200,000 and 300,000 tonnes per year capacity.

- The above mentioned capacity and the necessity to use primary iron (to meet product specifications) favours the DR/EAF steelmaking route.

E. Resource base

Total Arab world reserves of iron ore are estimated at more than 3 billion tonnes and at the same time potential resources are 9 billion tonnes consisting of low and medium grade ores. The most important deposits are located in Algeria (5 billion tonnes), the Libyan Arab Jamahiriya (3-5 billion tonnes), Mauritania (2 billion tonnes), Egypt (0.5 billion tonnes), and Saudi Arabia (0.4 billion tonnes).

Although most ESCWA countries are not yet using their iron ores in the production of steel, it has not been a deterrent to build an efficient industry depending on imports of needed raw materials.

For instance the annual requirements of some of the raw materials for the production of 100,000 tonnes per year and 150.000 tonnes per year special steels in the region are given in the table below.

1/ As of 1 January 1980.

2/ See J. Lepinski, A. Vallomy. The Direct Reduction/Electric Arc, Furnace Steelmaking in the Arab Steel Industry. The documents of the Arab Iron and Steel Union Electric Arc Furnace Symposium, Doha, Qatar, 1981.

Table III.3.3 Annual requirement of raw materials for the production of 100,000-150,000 ton/year special steel in the region

Raw material	Quantity, tonnes	
	100,000 t/y plant	150,000 t/y plant
Purchase components	121,800	182,620
Pig iron	9,200	13,920
Limestone	4,130	6,270
Burnt lime	2,760	4,180
Iron ore	1,380	2,090
Coke	830	1,250
Fluorspar	830	1,250
Sand	430	630
Sintered dolomite	2,750	4,180
Ferro-alloy	3,720	5,540

Source: Study on the promotion of special Steel Industry in the Arab States, vol.II (AIDO), 1980.

The specification of raw materials are given in the following table.

Table III.3.4 Specification of raw materials

	Fe %	SiO2 %	AL2O3 %	R2O3 %	CaO %	MgO %	F C %	S %	Ash %	CaF2 %	P %
Limestone	-	2-3	-	-	52-55	1-2	-	0.1 (max)	-	-	-
Iron ore	65 (min)	2-4	1-2.5	-	-	-	-	0.02 (max)	-	-	0.2 0.3
Coke	-	-	-	-	-	-	85 (min)	0.1	low	-	-
Dolomite	-	1-1.5	-	1.0	28-30	19-21	-	-	-	-	-
Fluorspar	-	7.0 (max)	-	4.0	-	-	-	-	-	85-91	

Source: Study on the promotion of special steel industry in the Arab States, vol.II, AIDO, 1980.

The availability of raw materials in the ESCWA countries and the necessity to import some of them are briefly reviewed in the subsequent paragraphs.1/

Scrap

Arab countries do not have substantial quantities of high grade scrap. This has deterred the growth of large semi-integrated steel mills based on electric arc furnace (EAF) technology.

1/ The survey of the availability of the resource base of the region was made on the base of some studies prepared by AIDO in the period from 1978 to 1982.

The supply of high grade scrap is even more difficult to ensure than the supply of coking coal. Of the 20 to 25 million tonnes of scrap traded internationally each year, about 40 to 50 per cent come from the United States.

The main exporters of scrap are the United States, the Soviet Union, France, the Federal Republic of Germany, Belgium and the Netherlands. Of these, the United States and the Soviet Union may be considered as potential sources of scrap supply for the ESCWA region.

Sponge iron

Sponge iron may be a possible substitute for scrap. Sponge iron as a substitute for scrap in electric arc furnaces is now well established. The manufacture of sponge iron by gaseous reduction process is also now fully established. As the ESCWA countries have plenty of natural gas resources and substantial deposits of iron ore, the prospect of production of sponge iron is very bright. The possibility of transporting sponge iron over long distances without deterioration of the quality has also been proved. Considering the above aspects, the replacement of scrap by sponge iron will ease the scrap shortage situation and will cut down the import of scrap to a great extent.

Pig iron

Pig iron is used for partial replacement as scrap and also to introduce carbon in the charge. The quantity of pig iron required is small and hence can be available within the Arab countries. However, if low phosphorus pig iron is needed for low phosphorus quality steel, low phosphorus iron may have to be imported.

Limestone

Limestone or burnt lime is an essential ingredient in electric furnace steelmaking. These materials are the source of CaO which is needed as a flux to form a slag and remove impurities such as silica, iron oxide, manganese oxide, sulphur and phosphorus. Limestone is normally used with the charge and the burnt lime is used for later lime addition, particularly for making a second slag. It is used in the iron and steel industry in Algeria, Tunisia and Egypt.

Iron ore

The quality of iron ores needed in iron and steel production is consistently improving. The average iron content rose from 40 per cent in 1940 to 57 per cent in 1971 and to 65 per cent in 1980. The trend towards a demand for high-grade ores and a high level of purity is expected to increase during the coming 10-15 years because there is a need to economize in materials and energy used in the standard process (blast furnace, DR steel works), and the increasing use of high grade and pure iron ores for the DR processes which are increasing in the world iron and steel industries.

The development of the iron and steel industry in the region seems to be independent from the mining and production of iron ores. Most of the countries with the exception of Egypt depend on imports of pellets for their iron and steel plants while the other countries are still exploring their resources. Reserves and chemical composition of iron ore of the ESCWA region are represented in tables 8 and 9, annex I.

Other oxidizing raw materials

Materials other than iron ore used as oxidizing materials are mill scale, sinter and gaseous oxygen. Mill scale/sinter is generally used in combination with or to replace iron ore. Mill scale (large Fe304) is a by-product formed in reheating furnaces in rolling mills, and as such is very cheap but it should be free from moisture and grease before use in the furnaces. Sinter is formed in sintering machines from a mix of coke breeze with iron ore fines, flue dust or other iron bearing materials. It is generally low in sulphur and is a satisfactory charge material if the density and iron content are high. Oxygen used in electric furnaces should be of 98 per cent or greater purity. Many of the modern electric furnaces have eliminated the use of iron ore as an oxidizing material, and used gaseous oxygen. Gaseous oxygen has a high purity, its use thus eliminates impurities such as silice associated with iron ore it is simple to use and control. In addition, gaseous oxygen, while decarbonizing, eliminates hydrogen and other disclosed gases to a greater extent than iron.

Fluorspar

Fluorspar is used almost solely as a slag conditioner. It serves to increase the fluidity of slag and helps to dissolve lumps of lime which have become coated with dicalcium silicate. Fluorspar used in the steelmaking process should have 85 to 91 per cent CaF2 and low silica content. Fluorspar occurs in Morocco. It was reported that in the mid-1980s, production of fluorspar in Morocco was 47,421 tons.

Dolomite

Dolomite is used extensively in electric furnaces for fettling, making up banks and bottoms, blocking doors and other repair work. Dolomite occurs both independently and along with limestone formation. Dolomite has been reported to occur in Syria, Saudi Arabia, and Egypt. It is however, possible to obtain a supply of suitable grade dolomite from Egypt and Syria. Reported grades of dolomite from Egypt and Syria indicate CaO from 29.67 per cent to 34.84 per cent, MgO from 17.47 per cent to 21.09 per cent and Si02 from 0.03 per cent to 2.32 per cent.

Refractories

Refractories are required as a lining in electric arc furnaces, reheating furnaces, and heat treatment furnaces to withstand high temperature, sudden changes in temperature, action of slag (acid or basic), molten metal, gases, volatile oxides, salts of metals etc. To meet the different service conditions, appropriate types and qualities of refractories are chosen for irdividual units.

Most of the refractories required in the steel production will have to be imported as there is no refractory plant in the ESCWA region except for some fire-clay bricks.

Graphite electrodes

The electrode consumption per tonne of ingot steel varies according to the quality of the steels produced and the size of the furnace. The entire quantity has to be imported, as graphite electrodes are not made in the ESCWA countries. The countries exporting graphite electrodes are the United States, the Federal Republic of Germany, the United Kingdom, Japan and India.

Natural gas

Historically, the available associated gas has been wasted in the ESCWA petroleum-producing countries, since it was being flared. The use of it in the DR process has become one of the most useful assets for the countries of the region. The gas wasted by OAPEC in the late 1970s, if used as a reducing agent, could have been used in producing 345 million tons of sponge iron.

Water

Water is an essential raw material in iron and steel production. From 80 to 200 m^3 of water are required in the production of one tonne of crude steel. The availability of water has to be taken into consideration in many countries of the region. Sea water desalination can of course help to solve the problems arising in the region.

Infrastructural aspects

The aspect of availability of stable sources of water and power will be of prime importance for installation of steel plants in the region.

The major utility requirements for the steel plant comprise water, power and fuel. While the cost of installing the utility distribution systems within the plant boundary may not vary significantly from location to location, the cost of off-site facilities to bring these services from their sources to the plant site could vary considerably depending on the plant location.

The development of power systems in the ESCWA countries has so far been localized, and it is expected that programmes will be initiated to form grids of the major existing stations. The investment required for captive power generation could vary at different locations depending upon the quantum of power available from external sources.

It has been estimated that annually about 98,000 million kilo-calories equivalent to 9,800 tonnes of fuel oil will be required for production of 100,000 tonnes of finished product. Fuel oil is available in the oil-producing countries. Therefore the transportation system available is of great importance.

It is understood that raw materials like scrap, pig iron, ferro-alloys, refractories and electrodes will have to be imported. Therefore any location near an existing developed harbour should be advantageous. The existing harbour should have the potential of integrating both the commercial and industrial functions of the proposed steel plants. The harbour catering for a steel plant should have provision for facilities and space for unloading, storing and subsequent despatch to the plant site.

For efficient operation of a steel plant, it is necessary to employ adequately trained staff in the various categories. In areas where training facilities for common skills exist, it may be necessary to provide minimum captive facilities only for the specialized skills for the steel plant. In places where there are no training facilities for common skills, elaborate training facilities are required.

Environmental factors

There is a growing global consciousness about ecology and pollution, and the measures required to control airborne, waterborne and noise pollution of environment by unworkmanlike location of an industrial plant. This may need additional capital investments. In some of the steel plants recently installed in Japan, for instance, the cost of such measures is reported to be ranging from 10 to 20 per cent of the total cost. In such cases, the cost of pollution control may, to a certain extent, influence the capital and annual costs and thereby contribute to the selection of the plant locations.

The cost of infrastructure facilities, often prohibitive for a given industry, may be tolerable if spread over several industries. Industries in the geographical vicinity may facilitate mobility of skilled labour and operative skills. The existence of common auxiliary industries and services in the area often results in substantial reduction by capital investment as well as operating costs. The iron and steel plants may be of different origin, manufactured to different environmental standards and may pose problems in this regard.

Chapter IV

CO-OPERATION AMONG COUNTRIES OF THE WESTERN ASIA REGION IN IRON AND STEEL

The iron and steel industry requires significant resources which are beyond the capacities of certain member countries of the region, co-operation between these countries allows for concrete results to be attained by each, and facilitates regional iron and steel industry integration.

The iron and steel industry is characterized by high capital intensity, high technological intensity, high scale of production and high skills. It is also an industry which consumes large amounts of raw material and energy. Since the capital, human and technological resources of most countries of the region are limited, the industry calls for co-operation in many areas.

A. Factors influencing co-operation

The problems of regional co-operation are primarily those of harmonizing national objectives within regional considerations, the most important of which are listed below:

(a) Economic viability of a project. Every investor desires a reasonable rate of return on the investment. If the country is convinced of the need for a project leading to a long-term period of industrialization, the rate of return in the short run may not be a key parameter for decision-making.

(b) Productivity and costs. A project located in a country with low productivity may have high production costs. This may penalize other countries in the region, who may have to subsidize the project by paying high prices for the product. In such a case, a maximum margin by which the indigenous product is costlier than an imported equivalent may be stipulated by the countries.

(c) Understandable concerns may exist in a country about being deprived of the benefits of the establishment of the industry if established, having to obtain its requirements from the regional undertaking and having to contend with local unemployment.

(d) A monopoly situation may arise and prices may be fixed at levels harmful to the steel consumer industries.

(e) The legal and organizational machinery required to pilot and finance such major multinational projects has to evolve and a number of questions need to be solved.

(f) The more immediate domestic needs of a country with slender financial resources may preclude its participation in long-term regional projects or render it difficult.

(g) The multiplicity of import/export tariffs needs to be sorted out and an appropriate lower tariff towards a common market needs, to be worked out.

Nevertheless, the benefits of regional co-operation are many. Apart from the material benefits of larger markets and economies of scale, specialization in the product-mix has to achieve maximum efficiency and productivity. Most of the problems of co-operation can be solved by establishment of the industry through joint ventures in which the investors from countries having substantial markets can participate.

B. Joint ventures in iron and steel processing

Joint ventures are known to be flexible instruments of regional co-operation as they can assume different modalities regarding initiatives for establishment, ownership, management and market arrangements. In comparison with joint ventures in other developing countries current inter-Arab multinational joint ventures are:1/

- Less concentrated in manufacturing activities and more concentrated in banking and financial services;

- More in the form of holding companies;

- More likely to be government-owned (especially in terms of the share of capital);

- Less likely to be majority-owned by the host country and to have adapted technology in the direction of smaller scale as well as greater labour intensity;

- More likely to have engaged in agricultural activities.

At the present time Arab joint ventures include both purely inter-Arab multinational ventures and those Arab multinational ventures which also involve other parties. Arab international multinational ventures would appear to have assets of about $US 40 billion.

In the ESCWA region the joint ventures in the manufacturing sector have proliferated in the Gulf area to a greater degree then in other countries of the region.

On 1 January 1984, there were about 109 Arab Gulf joint projects with a combined paid-up capital of $US 2.1 billion, and an authorized capital of $US 7.8 billion. This constitutes about 14 per cent of the fixed capital formation in the manufacturing sector (see table IV.1.1) In terms of broad economic categories, within the Gulf subregion, 29.6 per cent of the projects belong to chemical and mineral groups, 28.7 per cent to non-metallic minerals, 27.3 per cent to fabricated metal products, and 11.1 per cent to the food group of industry. Locations of 70 per cent of these projects are almost

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1/ See: United Nations Economic and Social Commission for Western Asia, Development Planning Division. Inter-Arab Joint Ventures in Western Asia: An Analysis of their Actual and Potential Contributions to Development and Regional Co-operation (E/ECWA/DPD/84/12), 30 September 1984.

equally shared between Saudi Arabia and the United Arab Emirates. Kuwait accounts for 12 per cent, Bahrain for 9 per cent, Oman for 6 per cent, Qatar and Iraq for 4 per cent.

Table IV.1.1 Structure of investment in joint industrial projects, 1983

PUC - Paid up capital $US million

NP - Number of projects

ISIC code	Manufacturing Sector	U.A.E		Bahrain		S. Arabia		Iraq		Oman		Qatar		Kuwait	
		PUC	NP	PUC	NP	PUC	NP	PUC	NP	PUC	NP	PUC	NP	PUC	NP
31	Food, beverages and tobacco	20	3	6	1	35	5	-	-	3	3	-	-	-	-
33	Wood and wood products	-	-			3	1	-	-	-	-	-	-	-	-
34	Paper, printing and publishing	6	2	-	-	2	1	-	-	-	-	-	-	-	-
35	Chemicals, fertilizers and plastic products	42	12	407	4	16	9	165	2	8	1	1	1	21	3
36	Non-metallic minerals	310	14	-	-	361	9	-	-	40	4	0.4	2	7	2
37	Basic metals	-	-	230	3	2	1	-	-	-	-	-	-	-	-
38	Fabricated metal products	61	7	334	3	13	13	-	-	-	-	-	-	0.3	1
39	Other manufacturing	-	-	-	-	0.3	1	-	-	-	-	-	-	-	-

Source: Badr. I. Mohyguddin. Joint Projects and Regional Co-operation: Industrial Co-operation in the Arabian Gulf. Quarterly journal issued by the Gulf Organization for Industrial Consulting (GIOC), No. 16, 1984.

One of the biggest joint ventures in the field of iron and steel production in the region is the Arab Iron and Steel Company (AISCO) in Bahrain. The Company is a joint investment venture pooling funds from Arab Governments, Arab Organizations and the public sector. The promoters of AISCO have selected Bahrain as a base because of its well developed infrastructure and its ideal geographical location. Moreover, the Government of Bahrain has authorized land reclamation for the site and has guaranteed long-term gas supply. This plant is at present the only operating pelletizing plant in the Arab world, especially after the closing of the similar plant in Morocco some years ago. The capital of AISCO is $US 150 million of which ARAMCO owns 10 per cent. The other shareholders are:

- Kuwait Foreign Trading, Contracting and Investment Co.
- Kuwait Metal Pipe Industries Co.
- Al Jazira Contracting and Investment Co.
- General Organization for Social Insurance, Bahrain.
- Al Sharja Group.
- Gulf Finance Centre, United Arab Emirates.

- National Industries Co., Kuwait

- National Bank of Bahrain.

- Bank of Bahrain and Kuwait, Bahrain.

- Al Ahli Commercial Bank, Bahrain.

The total investments reached $US 300 million. AISCO would aim its main efforts at securing a major share of the Arabian Gulf countries requirements for pellets. Since it is located very near to the Gulf DRI steel plants, it is reasonable to assume that AISCO would gain a little more than a 50 per cent share of the total pellet requirements for these plants in Qatar, Saudi Arabia and Iraq. AISCO has a sales target of 2 million TPY in the Gulf markets (Qatar, Saudi Arabia and Iraq), out of a total pellet requirement of 3.6 million TPY. There is also the possibility of new steel plants coming up in the Arabian Gulf late in the 1980s or early 1990s. The important point, however, is that AISCO is seeking markets in the Arab countries outside the Gulf area to ensure economic viability.

A joint venture for manufacturing steel sheets is being discussed between Jordan and Saudi Arabia, as Jordan's market alone is inadequate for steel sheet consumption on an uneconomic scale. Already, Jordan was considering import of defective steel coils, straightening and cutting them for indigenous use. Jordan is importing annually $US 25.30 million worth of steel sheeting. Saudi Arabia is looking for a partner. Jordan's contribution would be less costly labour and markets for an integrated steel complex producing mainly steel sheets. The advantage in locating the plant in Saudi Arabia is cheap power availability. However, for the present, only the partial manufacture of steel sheets is being contemplated. Both joint ventures will be in a position to improve their output with a more diversified range of products due to enlargement of resources. Such variety of products at cheaper costs is the result of the development and expansion of the Arab market. Ideally, the establishment of multinational joint ventures can be accelerated through promoting the mechanism of stock exchanges and homogenizing the investment legislation in ESCWA member countries. This could attract small shareholders' capital which otherwise has no place in the capital intensive iron and steel industry.

C. Complementaries and product specialization

An attempt was made in chapter II to obtain the approximate tonnages of the four main classes of products, viz., (a) tubes, pipes and fittings; (b) angles, shapes and sections; (c) bars and rods; and (d) universals, plates and sheets that would be needed in the years 1990 and 2000 in each of the 13 countries in the ESCWA region. Based on past consumption trends of the products, the projections of the demand for the region for 1990 and 2000 were estimated. These estimations are based on the regional and international statistical data available and long-term forecasts elaborated by ESCWA, UNIDO and other international institutions. Taking into account the under utilization of present capacities existing in the steel industries of the region (the current utilization is 40 to 60 per cent), and assuming there

is the opportunity to increase their operational rate by at least 60 to 75 per cent to the year 2000, these capacities are planned in the amount of 10,400 MTPY and 14,700 MTPY in the years 1990 and 2000 respectively.

Applying the percentage of distribution of the main product classes for the entire ESCWA region (see Chapter II table II. 3.10), the following rough picture of the product distribution of planned capacity for the ESCWA region emerges:

Table IV. 1.2 Projected capacities for ESCWA region

	(X 000 tonnes) 1990	2000
Tubes, pipes and fittings	1,877 (18%)	2,649 (18%)
Angles, shapes and sections	1,251 (12%)	1,768 (12%)
Bars and rods	5,423 (52%)	7,357 (50%)
Universals, plates and sheets	1,877 (18%)	2,943 (20%)
	10,428 (100%)	14,717 (100%)

Source: Estimated by the Joint ESCWA/UNIDO Industry Division.

Product mix

In planning individual steel plants for the ESCWA region to cater to the above projected capacities for the years 1990 and 2000, consideration will have to be given to economies of scale so as to maximize the viability of each plant for the benefit of the region as a whole. A possible distribution would be:

	Number of plants
Tubes, pipes and fittings	4
Angles, shapes and sections	1
Bars and rods	4-5
Universals, plates and sheets	1

As was mentioned earlier, the priority in resolving the problem of reducing the gap between existing capacities and the demand for steel products should be given to the measures aimed at increasing the level of utilization of the capacities already installed, rather than to setting up new capacities.

A special study is needed to identify the modalities having a direct bearing on these problems. It seems that a comparison between the total cost of imported steel products and the resources which can be required for undertaking such measures will have to be made.

For example, the imports of various steel products in the People's Democratic Republic of Yemen in the period from 1978 to 1980 were around 38,000 tonnes. These imports reduced the country's reserves in foreign

currency to $US 18.9 million.[1/] For the other countries of the region similar amounts of foreign currency expended on steel imports are by far larger than those which could be expected to increase the efficiency of existing capacities.

Due attention will have to be paid to the optimum of the product diversity. No ESCWA country, even in the distant future, will be able to meet its internal market for all types of rolled products through internal production. It is necessary that plants in ESCWA countries specialize in limited products to feed the regional market. This calls for co-operation arrangements for product diversity and specialization among the member countries.

D. Co-operation on the establishment of capacities for supplying inputs to the iron and steel industry

It is assumed that in consonance with modern technological trends, the direct reduction/electric arc furnace route will be adopted throughout the ESCWA region. The material inputs required for the capacities projected for 1990 and 2000, based on present-day norms of consumption in operating plants, are given below in order-of-magnitude figures.

Table IV. 1.3 The material input required for the capacities projected for 1990 and 2000

		(X 000)	
		1900	2000
Oxide pellets	(tonnes)	14,902	21,030
Water (cu.m.)		39,626	55,925
Gas (cu.m.)		3,336,960	4,709,440
Power (Kwh)		9,593,760	13,539,640
Purchased scrap	(tonnes)	772	1,089
Burnt lime	(tonnes)	626	883
Fluorite	(tonnes)	21	29
Ferro-manganese	(tonnes)	57	81
Ferro-silicon	(tonnes)	47	66
Aluminium	(tonnes)	10	15
Oxygen (cu.m.)		20,856	29,434
Silica sand	(tonnes)	52	74
Petroleum coke	(tonnes)	104	147
Graphite electrodes and nipples	(tonnes)	73	103
Refractories (fireclay, silica, magnesite-chrome, ramming mix, etc.)	(tonnes)	1,147	1,619
Rolls	(tonnes)	36	52
Fuel oil	(tonnes)	365	515

Source: Estimated by the Joint ESCWA/UNIDO Industry Division.

1/ UNIDO support to the Iron and Steel Industry: Three examples of Technical Assistance. Sectoral Working Paper Series No. 47. Sectoral Studies Branch, Division for Industrial Studies (UNIDO/IS.620), 21 March 1986. p.5

From the foregoing, the following modalities of co-operation emerge:

(a) Oxide pellets	Possibilities of joint ventures for a number of plants.
(b) Purchase scrap	Joint bulk purchase and shipping arrangements from foreign countries.
(c) Ferro-alloys	Possibility of regional joint venture for a plant.
(d) Graphite electrodes	Possibility of joint venture for more than one plant.
(e) Refractories	Possibility of joint ventures for a number of plants.
(f) Rolls	Possibility of joint venture for a rolls foundry.

E. Financing needs for iron and steel industry

Capital intensity of this industry warrants, especially in view of the limited financial capacities of some ESCWA member countries, an institutional approach in regional as well as international co-operation. While the equity part of financial requirements can be met through establishment of joint ventures, for the loan part - long-term and short-term - the existing pan-Arab, country level and international institutions have to be relied upon. In order to get leads into the solutions to the problem of finance, it will be necessary to quantify it. The following table gives the increments of production capacities in the steel industry as projectives.

Increments in iron and steel industry capacities for finished steel production

Year	(Tonnage Steel) Projecting Capacity (thousand tonnes)	Increment over the previous period (thousand tonnes)
1985	4,900	-
1990	10,428	5,528
2000	14,717	4,289

The costs of establishment and operation of the new capacities will vary with location, scale, source of procurement of plant and equipment, processes adopted, product mix, managerial efficiency etc. See in this respect annex II for selected investment cost per tonne of installed capacities in the world. To give an order of magnitude of required investment for the ESCWA region each tonne increment in iron and steel capacity taking present European prices can be estimated at around $US 2,000 as fixed investment. Additionally $US)0 may be required for working capital based on this, the total financing requirements will be of the following magnitude:

Period	Billion US$
1985-1990	12.1
1990-2000	9.4

F. Plant machinery and equipment

In the total capital requirements of an iron and steel project, plant and equipment account for about 60 to 65 per cent. For a steel plant with a capacity of approximately 1 million tonnes of crude steel per annum, about 80,000 - 85,000 tonnes of machinery and equipment will be required. In view of the limited market in the region for plant and equipment and the wide variety and heterogeneity of the types required for the iron and steel industry, it is not possible to cover the demand for all types of equipment. However, the kinds of equipment which can be considered for manufacture on a selective basis are small rolling mills, single and multistrand continuous casting machines for billets and up to medium size arc furnaces and small size induction furnaces. These are just a few examples in this regard. To be economical, the prime requirement will be that capital goods industry for iron and steel should be developed on a regional basis.

Historically, the development of the steel plant equipment building industry has been a difficult proposition for the developing countries. First and foremost, the domestic market could not sustain a steel plant equipment manufacturing industry. Secondly, the know-how for the equipment manufacture and the engineering design and detailing capacity, backed by continuing research and development, were not indigenously available and had to be imported. Thirdly, the huge investment required for establishing a steel machinery and equipment building plant was beyond the capacity of most developing countries.

It should be borne in mind that the prices of indigenously manufactured equipment are often higher than the prices of comparable imported equipment. This places the local manufacturing units at a disadvantage in bidding for equipment supply on steel plant contracts, not only at the national level but at the regional and international levels. It would therefore be necessary for local equipment manufacturing units be given a certain measure of protection to improve their competitive position.

A suggested plan of action for regional co-operation in equipment manufacturing/exchange would be on the following lines:

(a) Assessment of existing capacity in the country/region for the manufacture of steel plant and equipment and the type and range of equipment manufactured with a view to maximum utilization of installed capacity;

(b) Identification of new items of equipment, which could be easily manufactured with the existing capacity, by additional marginal facilities;

(c) Investigation into the possibility of co-operative manufacture of equipment by different units, each manufacturing one or more components/special parts for final assembly at a central plant;

(d) Co-ordination of equipment manufacturing facilities on the basis of complementarity at the national/regional level;

(e) Standardization of the size and range of equipment and components to facilitate their local/regional manufacture and interchangeability of components;

(f) Examining the possibilities of collaboration arrangements with leading manufacturers of steel plant equipment in the developed countries for establishing steel plant equipment manufacturing units for the region as a whole;

(g) Development of equipment design capabilities and drawing office facilities;

(h) Assessment of the steel plant equipment requirements for the region on the basis of the steel development programmes;

(i) Identification on areas where new equipment manufacturing is feasible, for which new capacity has to be created.

Apart from capital equipment, regional or subregional facilities for the engineering design and manufacture of spares required for the various steel plants in the region can well be considered.

G. Research and development

The technological developments in the iron and steel sector during the past two decades have been remarkable and have opened out new vistas for adoption of these developments in the steel manufacturing processes. Availability of research and development institutions in the region can form the vital link between the research field and industrial undertakings. In the ESCWA region there are two research and development institutions for the iron and steel industry which are located in Egypt. Additionally, there is one institution in Algeria.

Mention must be made of the Central Metallurgical Research and Development Institute in Egypt. The institute currently undertakes industrial research in various branches of metallurgy, including evaluation and benefication of ores, extraction and refining of metals; development of alloys; their heat treatment and shaping by casting and fabrication; studies

of physical; mechanical and chemical properties of metals and alloys; corrosion and its prevention and examination of failures; environmental protection and pollution control and utilization of waste materials. Consultancy services are also provided for the establishment of new industries, new products and modernization and expansion of existing plants. The Institute disseminates knowledge through documentation, publications, seminars, workshops, symposia and advanced training courses. It is well equipped for laboratory as well as pilot plant work in all branches of metallurgy.

Although the Institute's research and development programme is today designed primarily to meet the specific requirements of the Egyptian iron and steel industry, its activities may be extended to cover the long-term development plans and requirements of the other countries in the region as well.

The other metallurgical research and development institute located in Egypt is the Tibbin Institute for Metallurgical Studies. The objectives of this Institute are to prepare specialists to meet specific needs of the industry through study and continuing education programmes, to participate in industrial development and planning of metallurgical and allied industries, to undertake applied industrial research, to organize technical meetings, seminars, symposia, conferences and specific areas of the industry development.

Approximately 65 per cent of this Institute's activities are devoted to human resources development programmes and 35 per cent to technical assistance to industries.

At the present stage of development of the iron and steel industry in the region, it is not possible for each country in the region to have its own research and development facility for more than one reason, viz., costs, personnel availability, workload. The above two institutions therefore, offer excellent opportunities for regional co-operation in this field. Some of the specific areas which can be identified for this purpose are:

(a) Jordan - foundry sand testing;

- Ductile and grey iron casting production;
- Production of twisted reinforcement bars;
- Thickness of zinc coating on galvanized tubes.

(b) Syria - Production of twisted reinforcement bars;

- Foundry and testing;
- Thickness of zinc coating on galvanized tubes;
- Evaluation and testing of iron ores from the Aleppo region;

- Evaluation and testing of other raw materials to be used in a proposed iron and steel plant with integrated facilities;

- Iron and steel scrap treatment and preparation;

- Consumption of graphite electrodes and limestone in the electric arc furnaces.

(c) Qatar - When the present management services contract with Kobe Steel expires in 1986, the testing of iron ores for direct reduction, electric furnace operation and production of twisted reinforcement bars can well be undertaken by the two institutes in Egypt.

The foregoing are only illustrative of the scope that exists for regional co-operation and can well be extended to the other countries in the Western Asian region which have iron and steel industries. However, in the long run, consideration must be given to further development of these national institutes into regional centres for research and development in industry.

H. Industrial consultancy and engineering design

Consultancy organizations can play a vital role in developing steel production capacities and ensuring their efficient operation. Normally, there are three possible sources for acquiring the know-how required for installation and operation of a metallurgical plant. They are as follows:

(a) Import of technology from industrially advanced countries in well defined and selected areas to suit local resources and skills;

(b) Imports of technology, where available, from another developing country to minimize the problem of technology transfer;

(c) Developing indigenous technology with R and D activities, supporting services and institutional arrangements for its transfer to industry.

An examination of the cost of producing finished steel in new plants shows that raw materials constitute 40 per cent of the cost; processing, 10 per cent; depreciation and interest on capital, 50 per cent.[1/] Hence technology introduced to the region to increase the output of existing plants will be most appropriate if it contributes to reducing the capital to output ratio.

In a national context technology and innovations introduced also have to meet the requirements, of a government policy which might be undertaken towards a nationally preferred structure of the industry. On the other hand, the new forms of intensified technological competition, particularly between

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1/ See: R.K.Iyengar; S. Ramachandran. Appropriate technology for the iron and steel industry. UNIDO, Monographs on appropriate industrial technology No. 73. Appropriate industrial technology for basic industries. United Nations, New York, 1981. p.38

major developed market economies, may work against effective acquisition of appropriate technology to the region. In connection with this availability of consultancy and engineering design firms, it is a matter of great importance to pursue an independent technical policy in the iron and steel industry. There are some regional firms/organizations in the consultancy field in the ESCWA region. However, none of these organizations/firms are specialized in metallurgical industries. Some of these organizations can, however, serve as nuclei for the development of consultancy services in the iron and steel industry.

I. Operational know-how

An important component of regional co-operation establishment is the transfer of know-how in operation of the iron and steel plants after establishment. The mastering of the technological complexity, resulting from internal and external technical factors, has to be achieved mainly through the acquisition of appropriate technical know-how by the different persons involved in the field of iron and steel production. The socio-economic complexity can be mastered through the development of adequate behaviour that takes into account the cultural and socio-economic environment, and through adequate definitions of authority and responsibilities which have to be in harmony with the social and technical organization existing in a country and within an enterprise. Requirements of know-how, behaviour, authority/responsibility of the posts define to a great extent, the main context of programmes of training.

The training should cover the requisite number of key personnel at the steel works and at the collaborating enterprises, under the supervision of competent personnel, so that the trainees after completion of their training in operation and maintenance as well as in service units, such as production planning and control, quality control, repair shops, instrumentation, etc., can be entrusted with the commissioning and operation of the plant.

Normally, suitable training programmes are worked out for different categories of personnel indicating the duration of training. The training should cover both theoretical and practical instruction on jobs similar to those trainees would be performing at their plant.

Egypt has good opportunities to offer assistance to other countries in the region in every aspect of iron and steel, comprising also the transfer of know-how through training.

Started in 1975 with V.S.Steel and UNDP/UNIDO assistance, the National Centre in Egypt (Helwan), which is well known in maintenance management, spare parts manufacture and planned repairs with computerizing and inventory control, is now to be developed in to a regional centre for African countries in this field with UNIDO assistance.

Technical assistance has been provided by Egypt to Somalia, Pakistan, Turkey and some African countries through UNIDO. Egypt is reported to have sent over 1,000 technicians to other Arab countries, and 70 to 80 per cent of Egyptians working in other Arab countries are from the Helwan plant.

Maintenance management, spares manufacture and inventory control are vital areas in the iron and steel industry, in which other Arab countries in the Western Asian region can certainly look to Egypt for assistance.

The creditable performance of the Qatar Iron and Steel Company is in no small measure due to the willingness of the Japanese partners to transfer technology know-how to the Asian-Arab work-force and the ability of the latter to assimilate and absorb it without much difficulty. The Qatar plant has trained over 300 engineers from the Hadeed and Al-Jubail plants in Saudi Arabia, and is reported to be willing to accept trainees from other Arab countries in the Western Asian region, where the direct reduction (MIDREX), ultra-high-power electric arc furnace and continuous casting processes are either being set up or are already in operation.

Some examples to illustrate the kind of assistance needed by existing steel plants in the Western Asian region countries, and which can be obtained from the foregoing existing steel plants in Egypt and Qatar, are given below:

Jordan
- Improvement in operational efficiency and practices of the rolling mill;
- Improvement in operations of the pipe plant;

Syria
- Improvement in the present low capacity, utilization of the steel melting shops and rolling mills;
- Improved maintenance;
- Better scrap handling, preparation and treatment;
- Reduction in electrode and limestone consumption in the electric arc furnaces;
- Better housekeeping;
- Better operation of the steel pipe mill.

Apart from the foregoing, the two vital areas in every iron and steel plant in the Western Asian region which can benefit from the resources and expertise available in Egypt and Qatar are effective spares management and human resources development.

J. Manpower requirements

The projection of steel demand in the ESCWA region and a methodology for determining manpower requirements elaborated by UNIDO were the base for projecting personnel needs for the region in the years 1990, 1995 and 2000 (see tables IV.1.4 and IV.1.5).

These estimates can be used to make some tentative projections of working personnel requirements if the following factors are borne in mind.

(a) The estimations show that this number of working personnel will be required if the total demanded products are manufactured internally.

(b) Admittedly, only a part of these products will be manufactured within the region. Even though the present and rated capacities increase its operation from at present 40 to 60 per cent to 65 to 75 per cent in the future the share of the products manufactured internally will account for about 40 per cent of the total demand.

(c) In order to prepare estimates of personnel requirements for a country's iron and steel industry, an internal demand for imported product and level of capacities utilization as well as a number of other related factors has to be taken into account.

(d) The estimations presented in table IV. 1.4. apply to the process route involving EAF steelmaking on the basis of scrap. This process is the least labour intensive (5.5 man-hours per tonne) and hence the least complicated from the standpoint of direct labour expenditures, while complex labour expenditures for BOF steel are 20 per cent higher (6.6 man-hours per tonne).

(e) Total needs for personnel requirements for the process route involving EAF steelmaking on the basis of scrap for the production of 1 million tonnes rolled products are roughly 5.5 thousand people, with the following occupational structure of industrial and production personnel:

	Per cent
Engineers	3.9
Technicians	7.9
Mechanics	3.5
Electricians	2.1
Clerical staff	4.0
Workers	78.6
Total	100.0

(f) The indexes of the expenditures of working personnel required per 1,000 tonnes of different products manufactured can be changed in terms of local conditions, updating of technology and attracting innovations available from world-wide experience.

Training in the iron and steel industry does not only involve the personnel directly responsible for the plant, but also those indirectly involved in the development of the iron and steel industry (building up of the infrastructure and policy makers).

According to data published by UNIDO, a classical mini-plant, based on scrap and specialized in one product, with a production capacity of 200,000 TPY, will require approximately 230 persons of different qualifications to operate at optimum conditions. A larger mini-plant (400,000 TPY), with an enlarged product mix (bars, wire rod, merchant iron), will need approximately 650 people; the same mini-plant integrated with a direct reduction plant will

need approximately 750 people, and a classical large-scale integrated plant of 30 MTPY, between 6,600 to 8,300 people.[1/]

Training costs in developing countries are greater than in developed ones because of the need to build up the necessary infrastructure or to improve the existing infrastructure (engery supply, water system, housing) and because of the lack - total or partial - of trained personnel and training facilities (training centres). This means that, for similar plants, developing countries have to spend more resources for training than developed countries. The further development of trained centres available in the region as well as establishment of new ones on the base of inter-regional co-operation would be of vital importance for comprehensive development of the industry in the ESCWA region.

1/ See: The mastering of the technology and development of the Iron and Steel Industry in developing countries (UNIDO.ID/WG.458/12), 21 February 1986. p. 16.

Table IV.1.4. Projections of rolled steel demand in the ESCWA region and manpower required for manufacturing this demand.
(Numerator: demand in thousand tonnes; denominator: number of people to produce the demand)

	1990				1995				2000			
	Angles, shapes and sections	Bars and Rods	Universals plates and sheets	Total rolled product	Angles, shapes and sections	Bars and Rods	Universals plates and sheets	Total rolled product	Angles, shapes and sections	Bars and Rods	Universals plates and sheets	Total rolled product
Bahrain	25.2 139	73.3 405	19.2 123	117.7 667	33.4 184	86.2 477	25.0 161	144.6 822	39.8 219	103.1 571	32.6 270	175.5 1000
Egypt	529.9 2925	1772.5 9816	888.7 5733	3191.1 18474	698.5 3856	2181.0 12078	1197.5 7726	4077.0 23660	755.8 4172	2379.9 13069	1455.5 9391	4571.2 26632
Iraq	348.5 1924	1430.3 7919	657.4 4241	2436.2 14084	457.5 2525	1684.4 9325	855.5 5520	2997.4 17370	552.3 3049	2013.5 11150	1113.1 7182	3678.9 21381
Jordan	70.6 208	236.4 1309	57.6 372	364.4 1889	93.1 514	290.8 1610	77.7 501	461.6 2625	100.8 557	314.7 1743	94.4 610	509.9 2910
Saudi Arabia	443.7 2489	2926.7 16209	578.2 3730	3948.6 22388	582.5 3232	3446.6 19089	752.2 4853	4781.3 27174	703.2 3882	4120.0 22816	978.7 6314	5802.9 33012
Kuwait	122.5 476	478.8 2652	190.7 1230	792.0 4558	160.8 888	563.9 3123	248.2 1601	972.9 5612	194.2 1072	674.2 3734	322.9 2083	1191.3 6889
Lebanon	54.9 303	183.6 1016	62.0 400	300.5 1719	72.3 399	226.0 1251	83.6 539	381.9 2189	78.3 432	244.5 1354	101.3 655	424.4 2441
Oman	23.5 130	78.0 431	14.7 95	116.2 656	31.0 171	96.0 532	19.8 127	146.8 830	33.6 186	103.9 575	24.0 155	161.5 916
Qatar	14.4 80	63.2 350	23.8 154	101.4 584	18.9 104	74.4 412	31.0 200	124.3 716	22.8 126	89.0 493	40.3 260	152.1 879
Syria	113.6 627	450.4 2494	165.6 1068	729.6 4189	149.7 826	554.2 3069	223.1 1439	927.0 5334	162.0 894	599.6 3321	271.2 1749	1032.8 5964

Table IV.1.4. (Cont'd)

	1990				1995				2000			
	Angles, shapes and sections	Bars and Rods	Universals plates and sheets	Total rolled product	Angles, shapes and sections	Bars and Rods	Universals plates and sheets	Total rolled product	Angles, shapes and sections	Bars and Rods	Universals plates and sheets	Total rolled product
UAE	1327.8 760	464.1 2570	80.0 516	681.9 3846	181 999	546.5 3026	104.1 672	831.6 4697	218.5 1206	653.3 3616	135.5 874	1007.3 5696
Yemen Arab Republic	13.5 75	34.7 192	9.2 59	57.4 326	17.8 98	42.7 236	12.4 80	72.9 414	19.3 107	46.2 256	15.0 97	80.5 460
Democratic People's Republic of Yemen	2.2 12	2.8 15	1.4 9	6.4 36	2.8 15	3.4 19	1.9 12	8.1 46	3.1 17	3.7 20	2.4 15	9.2 52
Total ESCWA region	1900.4 10308	8194.8 45378	2748.5 17730	12843.7 73416	2499.3 13811	9796.2 54247	3632.0 23431	15927.5 91489	2883.7 15919	113225.6 62718	4587.2 29595	18796.5 108232

Source: Estimation of the Joint ESCWA/UNIDO Industry Division Based on:

(a) Tentative Projections of Steel Demand in the ESCWA region. UNIDO, Sectoral Studies Branch Division for Industrial Studies, Vienna 28. October 1985.

(b) Manpower and Training Requirements in Industry: A methodology with an application to the iron and steel sector (UNIDO/IS 544), 24 September 1984.

Table IV.1.5. Industrial and production personnel requirements for the process route involving EAF steelmaking for manufacturing rolled steel products

(men per total output)

	Angels, shapes and Sections				Bars and Rods				Universals, Plates and Sheets				Total rolled product		
	Total labour expenditure (man-hours per ton)	1990 output (000.tonnes)	1995 output (000.tonnes)	2000 output (000.tonnes)	Total labour expenditure (man-hours per ton)	1990 output (000.tonnes)	1995 output (000.tonnes)	2000 output (000.tonnes)	Total labour expenditure (man-hours per ton)	1990 output (000.tonnes)	1995 output (000.tonnes)	2000 output (000.tonnes)	1990 Total output (000.tonnes)	1995 Total output (000.tonnes)	2000 Total output (000.tonnes)
	1904.4	2499.3	2883.7		8195	9796.2	11325.6		2748.5	3632	4587.2		12843.7	15927.5	18796.5
	Personnel required				Personnel required				Personnel required				Personnel required		
1. Scrap preparation	0.716	680	895	1032	0.722	2958	3536	4089	0.756	1039	1373	1734	4677	5804	6855
2. EAF steelmaking	2.840	2699	3549	4095	2.862	11727	14018	16207	2.986	4103	5423	6849	18529	22990	27151
3. Rolling	1.976	1878	2469	2849	1.950	7990	9551	11042	3.000	4123	5448	6881	13991	17468	20772
4. Production of refractories	0.376	357	470	542	0.392	1606	1920	2220	0.380	522	690	871	2485	3080	3633
5. Production of lime	0.12	114	150	173	1.22	4998	5976	6909	1.26	1732	2288	2890	6844	8414	9972
6. Repair services	1.400	1330	1750	2019	1.404	5753	6878	7950	1.634	2246	2967	3748	9329	11595	13717
7. Energy facilities	1.684	1600	2104	2428	1.694	6941	8297	9593	1.762	2421	3200	4041	10962	13601	16062
8. Transport facilities	0.830	789	1037	1197	0.830	3401	4065	4700	0.970	1333	1762	2225	5523	6864	8122
9. General work services	1.100	1045	1375	1586	1.100	4507	5388	6229	1.290	1772	2343	2959	7324	9106	10774
Total	11.042	10492	13799	15921	12.174	49883	59629	68939	14.038	19291	25494	32198	79666	98922	117058

Source: Estimation of the Joint ESCWA/UNIDO Industry Division based on:

(a) Tentative Projections of Steel Demand in the ESCWA region. UNIDO, Sectoral Studies Branch Division for Industrial Studies, Vienna 28. October 1985.

(b) Manpower and Training Requirements in Industry: A methodology with an application to the iron and steel sector (UNIDO/IS 544), 24 September 1984.

Chapter V

TECHNICAL ASSISTANCE PROVIDED BY UNIDO

The iron and steel sector continued to be the largest recipient of UNIDO technical assistance deliveries in the metallurgical industry. UNIDO projections for the coming 10 years, show an anticipated growth of steel production facilities in regions like Latin America, India and the Middle East. In 1984 UNIDO technical co-operation expenditures under the heading metallurgical industries amounted to $US 6.3 million of which some 85 per cent from UNDP resources and in 1985 this figure was raised to $US 7.3 million of which 85 per cent comes from UNDP. A total of 150 technical assistance projects were implemented or under implementation in 1985.

The metallurgical industries regularly accounted for between seven to ten per cent of UNIDO total expenditures on technical assistance.[1/] UNIDO is supporting this trend for small-scale steel plants to promote self-sufficiency of developing countries and has been asked to undertake preliminary studies of this profile for various countries such as Yemen, Democratic Yemen and Afghanistan.

The 1990 and 2000 scenarios for the iron and steel industry prepared by UNIDO are a contribution into theoretical aspects of the iron and steel examination. The period after the third Consultation on the Iron and Steel Industry held at Caracas (Venezuela) in 1982 was one of active technical assistance related to the provision of expertise for effective operation of existing plants. Application was made of appropriate technologies, from advisory services and standardization of metal products, to the introduction of managed maintenance system in metallurgical plants and to energy conservation and environmental aspects. More than 70 technical co-operation projects have been initiated by the Metallurgical Industries Section of UNIDO since 1982. Some of them were initiated in the ESCWA region. (Egypt, Iraq and Democratic Yemen).

Another priority area was the planning, designing, establishment and operation of new metallurgical plants, including preparation of techno-economic and market studies. In this line a field mission to some countries of the ESCWA region was conducted by a UNIDO consultant earlier in August 1985. The mission resulted in a technical report on the iron and steel industry in the ESCWA region. That report and a desk research prepared earlier by the joint ESCWA/UNIDO Industry Division are the basis of the current report. Based on the observations made during the field mission and discussions held with various officials in different organizations of Jordan, Syria, Egypt and Qatar, listed below are the important areas in which regional co-operation can be started and also UNIDO activity could be desirable.

1/ See UNIDO, Support to the Iron and Steel Industry: Three Examples of Technical assistance. Sectoral Working Paper Series No. 47 (UNIDO/IS.620), 21 March 1986.

(a) The Arab region has reserves of iron ore, coal, natural gas, oil and other raw materials needed for the steel industry in order to establish a new, or to increase available industrial capacity in the Arab countries.

(b) The economies of scale can be widely made use of so that steel industries can be shared by other Arab countries. The efforts of Jordan and Saudi Arabia to establish a sheet steel industry are a case in point - Jordan offering cheap labour and markets and Saudi Arabia cheap electric power. In addition, Jordan's excellent and progressive infrastructure should attract attention from the rest of the Arab world in setting up downstream steel-consuming industries.

(c) There is a need for detailed study of the diversification programme in conjunction with an intention of Jordan, Egypt, Syria and Lebanon to manufacture cold strips for the electrical, steel furniture industries etc.

(d) All the facilities in Egypt for acquiring skills may well be needed by other Arab countries for the growth and development of their respective iron and steel industries. Egypt is already offering such assistance to African countries who are making extensive use of them. In the meantime there is a need for Egypt to sell its capabilities and resources in the steel industry if it wishes to render assistance to other Arab countries. To this end, the mission undertaken met with a positive response from the authorities of the General Organization for Metallurgical Industries, who agreed to take necessary measures for this purpose.

A number of industrial consultancy organizations that exist in the Arab world can well be harnessed in technical feasibility studies, project reports examination, selection of technology and equipment, and other areas that go into the establishment and expansion of steel industries in the Arab region.

Chapter VI

CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The ESCWA region comprises 3 groups of 13 countries, viz., oil producers, diversified economies and least developed countries, their per capita GDPs being $US 10,825, $ 1,508 and $ 510 respectively. It is one of the world's richest regions with about 50 per cent of the world's proven petroleum resources and some mineral wealth. Owing to huge petroleum resources the region remains a major source of surplus financial capital.

Depletion of the oil resources necessitates formulation of a long-term strategy of industrialization for the ESCWA region; however, the pattern of industrialization in most countries of the region has not changed significantly since the mid-1970s. Chemical industries, petroleum refining and plastics remained major contributors to MVA, representing 45.3 per cent of the total MVA in 1980, while the total contribution of the metal industries amounted only to 10 per cent in 1980.

The iron and steel industry in the ESCWA region is characterized by a wide diversity of the type of plants in various countries, but the ESCWA region's production capacities accounted for only 0.5 per cent of world installed capacities in 1982. The region produced only 0.3 per cent of the total amount of world crude steel, while the region's total demand for finished steel product was about 1.5 per cent of world demand in 1982.

The structure of the actually installed capacity in the region in 1982 was the following:

Iron production	- 2.5 MTPY
Crude steel production	- 3.1 MTPY
Rolling steel production	- 3.3 MTPY
Pipe production	- 0.3 MTPY

Total output of crude steel reached 1.3 MTPY in 1983; finished steel output amounted to 2.1 MTPY.

The ESCWA region has 54 per cent of the iron and steel making capacity in the Arab world. Current existing capacities for production of finished steel in the region barely total 4.9 MTPY. Egypt is the leading steel producer in the ESCWA region with about 2.0 MTPY capacity for a wide range of finished steel products and with a rather ambitious plan of reaching 15 MTPY by the year 2000. Current capacities of individual plants in the region vary from 20,000 tonnes/year to 1.5 million tonnes/year, from which a percentage share of the all kind works with capacities from 20 MTPY to 100 MTPY accounted for 20 per cent; over 100 MTPY to 600 MTPY accounted for 64 per cent and over 600 MTPY 10 per cent.

Current capacities of the region are working at 40-60 per cent of designed capacity owing to shortage of skilled manpower; workers drain and

their instability because of problems of salaries, housing, inadequate transport communication; poor maintenance and the lack of the necessary spare parts for long time operating equipment; inadequacy of raw materials to necessary specifications; etc.

Most of the existing plants in the region were built on the basis of individual local needs and resources of the countries of the region in the light of localized economic and industrial policies. Due emphasis on linkages with the pace-setting industries in the development of iron and steel industry has not been given serious attention so far.

There is a widening gap between supply and demand of iron and steel products in the ESCWA region. The regional consumption of finished steel products amounted to 9.2 million tonnes in 1983; imported products accounted for 7.1 million tonnes while the internally produced ones reached only 2.1 million tonnes. Underutilization of existing capacities, lack of diversity of the internal output and poor economic exchange among the countries of the region make for increasing the gap between demand and supply which has to be covered through imports.

Per capita consumption of steel in the region was 110 kg in 1982, comprising 88 kg of imports and 22 kg indigenous manufacture, but with fluctuations. Imports of steel in the region totalled a maximum of 8.7 million tonnes in 1982 - a sevenfold increase since 1965, with Saudi Arabia leading (over 50 per cent) followed by Egypt and Kuwait.

The total demand of the region is 66.3 per cent of that of the Arab world reflecting the heavy demand from the building sector. Demand of reinforcing bars is expected to account for 52 per cent of total ESCWA regional demand in 1985, while flat products and sections amount to 27 and 20 per cent accordingly. The forecasts of total demand for the region are about 16 MTPY by 1990 and about 23 MTPY in the year 2000. Rebars will account for 52 per cent of the total demand, sections 20 per cent and flats 28 per cent.

The absence of coking coal reserves in the region deters the adoption of the conventional BF/BOF route. For the ESCWA region with rich natural gas resources, the DR/EAF route is most appropriate.

B. Recommendations

Because the big gap between demand for and supply of finished steel products justifies accelerated expansion of the domestic steel industries in the region, as the first step there should be an increase in capacity utilization from the current 40 - 60 per cent to contribute to reducing this gap.

Considering the gap between supply and demand, rolling units in the region require aggregate capacities of 4 MTPY for hot rolled flats, 2 MTPY for cold rolled flats, 0.50 MPTY for heavy sections, 0.35 MTPY for light sections and 0.60 MPTY for seamless pipes. Neverthless, the priority should be given to the programmes aimed at increasing the level of utilization of the already existing capacities.

For the domestic steel industry, the DR/EAF steelmaking route is recommended. Initially, the products selected could be rebars, which have high market volume and are relatively easy to produce and seamless tubes, which are in great demand in oil producing countries. Due attention should be given to the optimum product diversity in terms of internal market requirements in the region.

Electric power is an important input, and regional grids of major stations (in place of existing localized installations) should be established. With growing global consciousness of ecology and pollution, the extra investments of 10-20 per cent of the total cost on this account should be considered.

Regional co-operation in the ESCWA region assumes paramount importance in the iron and steel industry because of disparities in resources and size of individual markets. Problems are many, particularly stemming from national considerations. Joint ventures involving funding, participation, ownership, technical assistance and balanced complementations of production; economies of scale should be adopted as a flexible instrument of regional co-operation.

Apart from providing funds in national budgets, regional financing bodies such as AIIC, AFESD and AIC, can play an important role. AIDO, GOIC, and AISU are regional organizations which can greatly contribute to the development of the steel industry in the ESCWA region. Research and development, industrial consultancy and engineering design, operational know-how, human resources development and plant equipment and machinery should be given adequate attention and support because they are the areas which lend themselves to regional co-operation.

On a material inputs, joint ventures should also be promoted for the manufacture of oxide pellets, ferro-alloys, graphite electrodes, refractories and rolls in economically viable units.

Strengthening of institutional infrastructure will enhance regional co-operation. In particular the following actions should be taken:

(a) The role of AIIC and APICORP in the development of iron and steel should be enlarged and strengthenned;

(b) AISU should assume the role of promoting production complementarities, specially in product-mix for the new plants, in view of scale economies for rolled products;

(c) Till new regional institutions are established and developed, existing national institutions/organizations/companies in individual countries should be given preference for conducting R & D and engineering activities for regional iron and steel industries.

ANNEXES

ANNEX I

ANNEXED TABLES

Table 1. Place of the ESCWA region within the framework of selected developing countries in 1982

Country	Territory (sq. km)	Population (million)	Per capita GDP (US$)
ESCWA region	4,820,624	95,000	3,117
	1,355,510 (a)		
		100,982 (b)	3,065 (b)
Brazil	8,511,965	124,020	2,232
Argentina	2,766,889	28,438	1,204
Mexico	1,972,547	71,193 (c)	2,346 (c)
Peru	1,285,216	18,320	1,204
Bolivia	1,098,541	5,755	1,054
Chile	756,626	8,800 (d)	1,456 (d)
Burma	676,525	33,640	187
Thailand	513,115	49,500	759

Source: Estimated by the Joint ESCWA/UNIDO Industry Division.

(a) Arable and rain-fed area suitable for cultivation.

(b) 1984.

(c) 1980.

(d) 1970.

Table 2. Steel output in the Arab World and in the ESCWA region in 1980-1983 (tonnes)

Country	1980		1981		1982		1983	
	Crude steel	Finished production	Crude steel	Finished production	Crude steel	Finished production	Crude steel	Finished production
Egypt	840200	...	895114	1033457	870280	947232	874125	960786
Syria	28000	91369	35000	116363	33400	81841	35000	99937
Jordan	-	80175	-	132477	-	123410	-	127916
Iraq	45428	61604	-	13850	-	12900	-	9000
Kuwait	-	36820	-	24683	-	24850	-	14610
Saudi Arabia	-	10000	-	65000	-	110000	-	380000
Qatar	463198	450400	429123	453436	498930	475400	460000	460000
United Arab Emirates	-	26000	-	27000	-	32000	-	-
Lebanon	...	...	...	...	...	...	...	...
Total ESCWA region	1376826	756368	1359237	1866266	1402610	1807633	1369125	2052249
Algeria	427200	900216	644516	1082282	985627	1105112	1022836	1069615
Tunisia	144000	169846	147000	163523	89000	160603	139000	161474
Libyan Arab Jamahiriya	-	92000	6900	31314	9300	49352	4800	68436
Mauritania	5100	4000	5300	4000	10300	6000	9000	5500
Morocco	-	13500	-	13500	-	18000	-	18000
Sudan	-	33000	-	33800	-	58800	-	-
Total Arab world	1953126	1968930	2162953	3194685	2496837	3205500	2544761	3375274
ESCWA region as a per cent of total Arab world	70.0	38.4	62.8	58.5	56.2	56.5	53.8	60.8

Source: Compiled by the Joint ESCWA/UNIDO Industry Division, derived from the data available in AIDO and from AISU statistics, presented to the second Arab Congress on Steel Industry held in Bahrain in 1982.

Table 3. Iron and steel designed capacities by country and factory as of 1982

(Thousand tons)

Country	Kind of factory	Iron			Crude steel			Final products		
		Technology	Design capacity	Year of operation	Technology	Design capacity	Year of operation	Unit of production	Design capacity	Year of operation
1- EGYPT										
(a) Iron and Steel Company (Helwan)	Fully integrated	High furnace (No.1)	205	1958				Mass rolling sections 900 mm diameter	200	1958
		High furnace (No. 2)	205	1958	4 Thomas converters 17 ton cap. per unit.	300	1958	Heavy rolling sections 750 mm	125	1958
		High furnace (No. 3)	670	1973	Oxygen converters	1200	73-77	Light rolling sections 280-360 mm	70	1964
		High furnace (No. 4)	670	1977	2 electric ovens 12 ton per unit	50	1958	Rolling sections	200	1977
					Continous casting	1500	73-77	Rolling sections cold	40	1977
								Rolling plates	75	1958
								Sheets hot	500	1971
								Sheets cold	260	71-73

Table 3. (Cont'd)

(Thousand tons)

Country	Kind of factory	Iron			Crude steel			Final products		
		Technology	Design capacity	Year of operation	Technology	Design capacity	Year of operation	Unit of production	Design capacity	Year of Operation
(b) Private company for metallurgical Industries	Semi-integrated				2 Seimens Martin Ovens 25 ton cap.	100	1948	Rolling reinforced steel semi-mechanical	96	1948
								Rolling reinforced steel mechanical	145	1976
(c) Delta Steel Factories	Semi-integrated				Electric Oven 18 ton cap.	30	1947	Rolling iron wires	60	1947-1965
					Electric Oven 25 ton cap.	40	1971	Rolling sections	40	1976
					Electric Oven 25 ton cap.	40	1978			
(d) HASR Company of Pipes								Spiral pipes	20	1963
								Elongated pipes	10	1963
2- SYRIA										
(a) Geco Steal Company	Semi-integrated				2 electric oven 30 ton per unit.	130	1979	Reinforced iron rolling 6mm-25mm	120	1971
					2 continuous casting units 2 lines/ producing unit.			Pipes elongated welded	20	1977-1979
3- JORDAN										
(a) Al-Ragheb Company	Rolling							Reinforced iron rolling	40	1975
(b) Jordanian Iron & Steel Industry Company Ltd.	Semi-integrated	-	-	-	Electric oven	30	1976	Reinforced iron rolling	75	
(c) Pipe Company	Pipes	-	-	-	-	-	-	Pipes 1-4" diameter	30	1978

Table 3. (Cont'd)

(Thousand tons)

Country	Kind of factory	Iron			Crude steel			Final products		
		Technology	Design capacity	Year of operation	Technology	Design capacity	Year of operation	Unit of production	Design capacity	Year of Operation
4- LEBANON										
(a) Lebanese Company for Steel Industry	Rolling	-	-	-	-	-	-	Reinforced iron	240	1963
(b) United Steel Company	Rolling	-	-	-	-	-	-	Reinforced iron	90	1964
(c) National Pipe Company	Pipes	-	-	-	-	-	-	Steel pipes welded, black & galvanized	78	1957
(d) Lebanon Pipe Company	Pipes	-	-	-	-	-	-	Steel pipes welded black & galvanized	12	1960
(e) Ghanis Kassar Joyan Pipe Company	Pipes							[Pipes]		
5- IRAQ										
(a) Iron and Steel Complex Khor Al-Zubair	Fully integrated	DR MyL	400	Late 1978	14 electric ovens 70 ton capacity per unit.	500	-	Reinforced iron rolling	240	1978
					2 continuous casting units (6 lines)			Sections	160	
(b) Spiral welded pipes Factory	Pipes							Spiral welded pipes	55	
6- KUWAIT										
(a) Kuwaiti Company for Metallic Pipe Industry	Pipes							Spiral welded pipes production	116	1967

Table 3. (Cont'd)

(Thousand tons)

Country	Kind of factory	Iron			Crude steel			Final products		
		Technology	[illegible]	Year of [illegible]	Technology	Design capacity	Year of operation	Unit of production	Design capacity	Year of Operation
7- UAE										
(a) Private Company for Steel of Dubai	Semi-integrated				Electric ovens	45		Reinforced iron rolling	36	Started 1976 stopped then started again 1978
(b) Ras Al-Khaima Organization	Semi-integrated	-	-	-	Electric ovens	65		Reinforced iron rolling	50	
(c) Abu-Dhabi Factory	Rolling							Reinforced iron	25	1976
8. QATAR										
(a) Qatar Company for Iron and Steel	Fully integrated	DR	400	1978	2 electric ovens, 70 ton capacity per unit. (2 continuous casting units, 4 lines for each unit).	416	1978	Reinforced iron	330	1980
9. SAUDI ARABIA										
(a) Jeddah Rolling Factory	Rolling	-	-	-	-		-	Reinforced iron rolling	140	1966 1980

Source: Annual Bulletin, Iron and Steel Industry in the Arab World in figures. AMIB, AIDO, 1982 (Arabic).

Table 4. Demand for iron and steel products in the Arab World
('000 tons)

	1978	1980	1985	1990	1995	2000
ESCWA region countries						
Egypt	1,400	1,820	2,760	3,780	4,800	5,900
Syria	496	618	810	1,000	1,200	1,400
Saudi Arabia	1,000	1,400	2,350	3,300	4,230	5,240
Kuwait	240	420	550	670	780	890
Bahrain	41	62.5	90	116	143	170
Qatar	58	88	123	158	194	230
Lebanon	-	-	500	800	1,000	1,440
Jordan	-	185	275	360	450	550
U.A.E.	360	580	907	1,230	1,560	1,880
Iraq	62	250	1,350	1,760	2,170	1,580
ESCWA region total	3,657	5,423.5	9,715	13,174	16,527	19,280
Oil exporting countries of the region	1,761	2,800	5,370	7,294	9,127	10,990
Oil exporters as % of the ESCWA region	48.2	51.6	55.3	55.4	55.0	57.0
Other Arab World countries						
Algeria	1,600	1,670	2,440	3,110	3,780	4,460
Tunisia	400	430	640	840	1,000	1,200
Libyan Arab Jamahiriya	237	420	640	960	1,350	2,180
Mauritania	2.2	4.55	9	18	36	72
Morocco	561	780	1,060	1,359	1,660	1,990
Sudan	110	110	150	200	216	350
Other Arab World countries total	2,910.2	3,414.55	4,939	6,487	8,142	10,252
Arab World total	6,567.2	8,838.05	14,654	19,661	24,669	29,532
ESCWA region as % of total Arab World	55.7	61.4	66.3	67.0	66.9	65.3
Oil exports of the ESCWA region as % of total Arab World	26.8	31.7	36.6	37.1	37.0	37.2

Source: ESCWA Compiled from Iron and Steel International, August 1984.

Table 5. Major exporters of semi-finished finished steel product into the ESCWA region

(000 tonnes)

		Australia	Austria	Belgium Luxemburg	Czechoslovakia	France	Germany F. Republic	Italy	Japan	Netherlands	Poland	Turkey	United Kingdom	Yugoslavia	Spain	Total major exporters
Bahrain	1981	0.08	-	1.00	-	7.89	2.69	0.11	40.00	1.21	-	-	2.64	-	0.43	56.05
	1982	4.54	-	1.53	-	0.24	1.45	0.31	77.23	2.55	-	-	9.89	-	-	97.74
	1983	2.0	-	1.07	-	1.52	2.84	6.40	60.48	34.93	-	-	3.39	-	0.06	112.69
Egypt	1981	16.49	11.27	16.0	117.30	33.54	81.73	80.63	83.45	3.11	40.90	-	23.45	4.11	167.38	675.35
	1982	-	30.29	13.12	253.10	62.15	108.62	55.86	101.58	7.73	41.82	-	23.54	11.97	-	709.78
	1983	5.89	10.13	31.26	273.60	50.02	108.73	104.29	112.42	1.86	44.18	3.89	37.29	97.43	117.59	998.68
Iraq	1981	6.47	2.05	218.0	77.20	127.04	114.34	89.68	689.80	7.76	14.25	-	36.64	18.64	123.38	1525.25
	1982	13.39	5.67	70.89	0.50	65.11	149.32	64.26	293.09	9.95	-	-	39.02	31.28	-	742.48
	1983	-	4.11	54.09	-	19.95	39.60	13.29	69.77	5.25	0.59	85.20	31.73	19.12	132.43	475.13
Jordan	1981	0.03	0.66	12.00	-	22.81	18.83	17.12	31.7[illegible]	1.80	1.05	-	5.22	-	9.83	121.14
	1982	-	3.88	7.03	7.30	35.68	17.23	13.86	45.10	10.79	0.84	-	9.36	-	-	151.07
	1983	-	0.79	11.38	15.70	22.83	1.57	10.05	34.27	1.24	0.50	-	7.01	0.83	33.79	139.96
Kuwait	1981	8.42	0.01	11.0	12.40	4.93	32.26	22.20	353.99	2.41	1.11	-	50.22	-	35.32	534.27
	1982	6.64	-	14.11	-	8.04	36.36	3.94	727.30	2.16	1.16	-	20.80	0.04	-	820.55
	1983	7.04	0.02	8.00	-	13.46	25.40	5.44	507.62	4.22	2.69	3.66	15.54	0.24	12.46	605.79
Lebanon	1981	-	10.04	16.0	34.80	16.62	20.[illegible]1	104.85	10.36	1.53	0.10	-	4.62	0.32	10.99	230.84
	1982	-	14.88	11.62	46.30	19.03	25.71	68.79	4.19	0.64	-	-	7.30	2.19	-	200.65
	1983	-	5.39	24.17	57.80	21.5	17.28	64.14	2.19	0.17	-	15.91	3.82	0.23	31.04	243.48
Saudi Arabia	1981	1.42	0.30	53.0	19.20	43.90	193.58	207.43	1423.56	43.95	0.78	-	20.02	-	92.64	2099.78
	1982	22.50	1.21	31.42	38.00	107.14	246.19	73.07	3132.60	57.69	-	-	75.24	-	-	3785.06
	1983	37.25	1.42	49.02	27.70	89.23	129.55	118.46	2258.25	29.72	-	12.77	[illegible]4.70	-	115.42	2963.43
Syria	1981	-	9.13	27.0	45.80	11.60	87.59	147.03	2.75	11.87	10.16	-	2.10	0.13	185.25	540.41
	1982	-	4.56	4.77	7.80	7.95	19.87	34.30	1.98	20.11	-	-	2.58	0.62	-	105.54
	1983	-	9.06	26.90	60.40	13.76	32.47	23.63	2.82	0.28	-	2.71	2.19	0.10	3.88	178.2
Other Middle East	1981	0.18	0.17	18.0	12.10	73.72	41.32	47.99	585.42	13.04	-	-	50.16	-	5.36	847.46
	1982	0.07	2.32	19.22	23.00	44.87	67.90	31.61	779.30	14.17	-	-	59.02	-	-	1041.48
	1983	2.20	0.58	25.12	7.80	38.08	92.84	27.73	640.50	5.25	-	-	41.63	-	60.28	942.01
Total	1981	33.08	33.63	372.0	318.8	342.05	592.95	717.04	3721.12	86.68	68.35	-	195.07	23.2	630.58	6634.55
	1982	47.14	62.81	173.7	376.0	550.21	672.65	346.00	5163.37	125.79	43.82	-	246.75	46.1	-	7654.35
	1983	54.48	31.5	231.01	443.0	270.19	450.28	373.37	3688.32	82.92	47.96	124.14	237.30	117.85	506.95	6659.37
Share of each in total export (%)	1981	0.5	0.5	5.6	4.8	5.1	8.9	10.8	48.7	1.3	1.0	-	2.9	0.4	9.5	100.0
	1982	0.6	1.0	2.3	4.9	4.6	8.7	4.5	67.4	1.6	0.6	-	3.2	0.6	-	100.0
	1983	0.8	0.5	3.5	6.6	4.1	6.8	5.6	55.4	1.2	0.7	1.8	3.6	1.8	7.6	100.0

Source: ESCWA compilation based on international trade statistics.

Table 6. Steel consumption in the world (crude steel)

Countries and areas	Production 1977-1981 (mln. tons)	Population (millions)	Per capita consumption (kg)
EEC 10	107	297	360
Other Western Europe	32	49.1	652
U.S.A.	134	223.6	599
Canada	14	24.3	576
Japan	73	115.3	633
South Africa	6	28.2	212
Oceania	6	23	260
Total industrialized countries	372	760.5	489
Latin America	34	350.3	97
Asia (exc. Japan)	35	2346	15
Africa (exc. S. Africa)	8	342.3	23
Arab countries (exc. ESCWA region)	7	84.2	83
ESCWA region	9	81.8	110
Total developing countries	93	3168	29
Total countries with a market economy	466	3928.5	118.6
USSR and Eastern Europe	208	395.7	525
China and Democratic Republic of Korea	45	970.6	46
Centrally planned economies, Total	253	1366.4	185
World total	719	4324.3	166.2

Source: ESCWA estimation based on different international statistics and international trade statistics.

Table 7. Steel production in the ESCWA region in 1980-1983 (by products) (000 Tonnes)

Countries / Products	Egypt				Syria				Jordan				Iraq			
	Years															
	80	81	82	83	80	81	82	83	80	81	82	83	80	81	82	83
1. Crude steel	840.2	895	870.3	874.1	28.0	35.0	33.4	35.0	-	-	-	-	45.4	-	-	-
Ingots	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Billets	-	266.1	337.7	317.8	29.3	35.1	32.5	35.8	-	-	-	-	37.7	-	-	-
Slabs	-	448.8	401.0	415.1	-	-	-		-	-	-	-	-	-		-
2. Reinforcing bars	...	163.03	179.9	183	79.9	102.4	66.9	84.1	68.0	118.0	111.0	115.0	21.1	-	-	
Wire	-	-			-	-	-	-		-	-			-	-	-
Bars and wire rods	-	-	..	-	-	-	-	-	-	-	-	-	-	-	-	-
Light sections	...	35.8	41.2	40.5	-		-	-	-	-	-	-	0.7	-	-	-
Heavy sections	...	107.2	117.2	114.3	-	-	-	-	-	-	-	-	18.4	-	-	-
Rails & accessories	...	14.4	15.4	11.3	-	-	-	-	-	-	-	-	-	-	-	-
3. Coils for rerolling	...	355	287.8	298.2	-		-	-	-	-	-	-	-	-	-	-
Plates and sheets	...	252.2	197.8	196.7	-	-	-	-	-	-	-	-	-	-	-	-
Strips	...	105.4	107.8	116.6	-		-	-	-	-	-	-	-	-	-	-
Tinplates	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4. Welded tubes	-	-	-	-	11.4	14.0	15.1	15.8	12.1	14.5	12.4	12.9	21.3	13.8	12.9	9.0
Seamless tubes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Galvanized tubes	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Total (2+3+4)		1033.03	947.1	960.6	91.3	116.4	81.8	99.9	80.1	132.5	123.4	127.9	61.5	13.8	12.9	9.0

Table 7 (Cont'd)

(000 Tonnes)

Countries / Products	Saudi Arabia				Kuwait				Qatar				United Arab Emirates			
	Years															
	80	81	82	83	80	81	82	83	80	81	82	83	80	81	82	83
1. Crude steel	-	-	-	-	-	.	-	-	463.2	429.1	498.9	...	-	.	.	.
Ingots	-	-	-	-	-		-	-	-	-	-	-	-		.	.
Billets	-	-	-	275.0	-	-	-	-	450.4	458.1	483.1	...	-	-	-	-
Slabs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Reinforcing bars	10.0	65.0	110.0	330.0	-	-	-	-	450.4	453.4	475.4	460.0	26.0	27.0	32.0	...
Wire	-	-	-	50.0	-	-	-	-	-	-	-	-	-	-	-	-
Bars and wire rods	-		-	-	-	-	-	-	..	-	-	-	-	-	-	-
Light sections	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Heavy sections	-	-	-	-	-	-	-	-	-	-		.	.		.	-
Rails & accessories	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3. Coils for rerolling	-	-	-	-	-	-	-	-	-	-	-	-	-		.	-
Plates and sheets	-	-	-	-	-	.	-	-	-	-	-	-	-	-	-	-
Strips	-	-	-	-	-	-	-	-	-	-		-			.	-
Tinplates	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4. Welded tubes	-	-	-	-	33.7	21.9	21.6	12.9	-	-	-	-	-	-	-	.
Seamless tubes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Galvanized tubes	-	-	-	-	3.1	2.8	3.2	1.6	-	-	-	-	-	-	-	-
Total (2+3+4)	10.0	65.0	110.0	380.0	36.8	24.7	24.8	14.5	450.4	453.4	475.4	460.0	26.0	27.0	32.0	--

Table 7 (Cont'd)

(000 Tonnes)

Countries / Products	Total ESCWA region				Total Arab Worlda a/				ESCWA region as a per cent of total Arab world			
	Years											
	80	81	82	83	80	81	82	83	80	81	82	83
1. Crude steel	1376.8	1359	1402.6	1369	1953	2163	2497	2544.7	70.4	62.8	56.1	53.8
Ingots				-	-	-	-	-	-	-	-	-
Billets	517.4	759.3	853.3	628.6	695	939	970	648.4	74.4	80.8	88.0	97.0
Slabs	-	448.8	401	415.1	-	448.8	401	415.1	-	100.0	100.0	100.0
2. Reinforcing bars	655.4	929.1	975.0	1172.1	1093	1357	1404.0	1590.6	60.0	68.5	69.5	73.7
Wire	-	-	-	50.0	14.0	20.0	15.0	71.0	-	-	-	70.4
Bars and wire rods	-	-	-		3.2	1.2	0.8	1.1	-	-	-	-
Light sections	0.9	35.8	41.2	40.5	0.7	35.8	41.2	40.5	100.0	100.0	100.0	100.0
Heavy sections	18.4	107.2	117.2	114.3	18.4	107.2	117.2	114.3	100.0	100.0	100.0	100.0
Rails & accessories	...	14.4	15.4	11.3	...	14.4	15.4	11.3	...	100.0	100.0	100.0
3. Coils for rerolling	...	355.1	287.8	298.2	306.3	855.6	854.0	759.0	...	41.5	33.7	39.3
Plates and sheets	...	252.2	197.8	196.7	22.8	270.0	221.0	214.5	...	93.4	93.7	91.9
Strips	...	105.4	107.8	116.6	238.2	343.7	346.3	417.5	...	30.7	31.2	27.9
Tinplates	-	-	-	-	-	-	-	-	-	-	-	-
4. Welded tubes	78.5	64.2	62.2	50.6	229.0	153.0	144.1	119.0	34.3	41.8	36.0	42.5
Seamless tubes	-	-	-	-	40.0	34.0	43.3	34.8	-	-	-	-
Galvanized tubes	3.1	2.8	3.2	1.6	3.1	2.8	3.2	1.6	100.0	100.0	100.0	100.0
Total (2+3+4)	756.3	1866.2	1807.6	2052	1968.9	3194.7	3205.5	3375.2	38.3	58.4	56.4	60.8

Source: Compiled by the Joint ESCWA/UNIDO Industry Division derived from the data available in AIDO and from AISU statistics presented to the Second Arab Congress on Steel Industry held in Bahrain in 1982.

a/ ESCWA region and other Arab countries, including Algeria, Tunisia, Libyan Arab Jamahiriya, Mauritania, Morocco, and Sudan.

Table 8. Iron ores in the ESCWA region and their chemical composition (1980)

	Country	Reserves (million tonnes)				Chemical analysis (percentages)					
		Proved	Indicated	Inferred	Total	Fe	SiO_2	Al_2O_3	P	S	Mn
1.	Egypt	338	187	-	525	43-58.5	2.66-20	-	0.05-1	0.3-0.5	1.9-4.03
2.	Syria	80.546	63	-	143.546	13.8-33.1	11.8-21	6-11.9	0.4-1.3	0.04-0.1	-
3.	Jordan	0.660	-	-	0.660	60.4-63.4	-	-	-	-	-
4.	Iraq	-	-	28.9	28.9	16-30	-	-	-	-	-
5.	Saudi Arabia	56.5	762	1800	2618.5	42-80	3-16	4	0.16-0.5	-	-
6.	Total	475.706	1012	1828.9	3316.606	13.8-80.0	2.66-21.0	4-11.9	0.05-1.3	0.04-0.5	1.9-4.03

Source: AIDO Study on Arab Iron and Steel Industry, 1980.

Table 9. Chemical composition and location of Iron ore reserves in the ESCWA region

Country	Name of mine	Chemical Analysis (percentage)						Reserves (million tonnes)			
		Fe %	SiO_2%	Al_2O_3%	P %	S %	Mn %	Proven	Indicated	Inferred	Total
Egypt	1. Aswan	44-47	14-18	-	1-0.6	-	2.5	25	158	-	183
	2. Bahriyah										
	Nasser	51.54	3.7	-	0.059	0.49	4.54	23	-	-	23
	Agraby	50.25	8.73	-	0.120	0.50	4.27	57	-	-	57
	Jedidah	58.5	2.66	-	0.190	0.84	1.97	100	29	-	129
	Al-Harah	49.25	9.12	-	0.119	0.35	4.03	33	-	-	33
	Eastern Desert Ores	43	20	-	-	-	-	100	-	-	100
Total								338	187	-	525
Syria	I. Afrin Area										
	1. Rajo	13.8	15.8	11.9	0.58	0.04	-	26.215	-	-	26.215
	2. Almdar	31.03	11.8	11.9	0.58-1.3	0.2	-	21.331	-	-	21.331
	3. Qubra	-	-	-	-	-	-	-	14	-	14
	II. Alzabadani Area										
	1. Jedida Abous	33.1	20	6-8	0.48	0.08-0.1	-	33	42	-	75
	2. Al-Baudah	27.8	18-21	6.7-7.6	0.4	0.05	-	-	7	-	7
Total								80.546	63	-	143.546
Jordan	Wardah Jabal Haloun	60.40	-	-	-	-	-	0.600	-	-	0.600
	Al-Zarqa	65.40	-	-	-	-	-	0.060	-	-	0.060
Total								0.660			0.660
Iraq	Darbanda	16	32	22	0.03	0.03	-	-	-	-	1
	Al-Hussienia	24	-	-	-	-	-	-	-	-	25
	Adhamay	30	-	-	-	-	-	-	-	-	1.3
	Hafra	30	-	-	-	-	-	-	-	-	2.5
	Kisho	20-30			-	-	-	-	-	-	-
Total											29.8
Saudi Arabia	Wadi Sawawin	42	16-13	-	0.2-0.5	-		-	390	1000	1390
	Wadi Fatima	46.2	12	4	0.4	-		48.5	-	-	48.5
	Jabil Idsas	65	3	-	0.16	-		8	-	-	8
	Wadi Wasat	-	-	-	0.16	-		-	72	-	72
	Fe_2S-80	-	-	-	-	-	-	-	300	800	1100
Total								56.5	762	1800	2618.5

Source: AIDO Study on Arab Iron and Steel Industry, 1980.

Annex 11

SUMMARY

THE PATTERNS OF COSTS PER TONNE OF STEEL INSTALLED IN THE WORLD IN THE MID-1970S

1. Developed countries

- $US 1,000 per tonne in the case of integrated plants (capacity 1 MTPY)

- $US 700 to 800 per tonne in the case of extension investments

- $US 300 to 800 per tonne in the case of small semi-integrated plants

Although the installation cost of an integrated plant was estimated as $US 1,000 per tonne in the industrialized countries, this estimation was largely exceeded by escalating costs.

2. Developing countries

At the beginning of 1981, $US 1,700 and $US 1,800 per tonne installed were minimum figures for the construction of integrated plants. Cost exceeding $US 2,000 per tonne had to become the rule in such projects as:

- Misurata in the Libyan Arab Jamahiriya, about $US 2,600 per tonne

- Zulia in Venezuela, approximately $US 3,000 per tonne (including coal mine).

- Ajaokuta in Nigeria, $US 3,000 to $US 4,000 per tonne

The costs of semi-integrated plants using the electric furnace/direct reduction route have followed the same progression. This is shown by the following projects:

- Dekkheeila in Egypt, around $US 1,250 per tonne

- Jubail in Saudi Arabia, around $US 1,000 per tonne

- Jitel in Algeria, around $US 2,000 per tonne

The increase in unit cost has repercussions on the industry's operating costs. An installation cost per tonne of $US 2,000 results in an approximate charge of $US 200 per tonne of steel produced (approximately 10 per cent).

3. General remarks

Due to the process of inflation at the world-wide level which began during the mid-1960s, the cost of a tonne of steel capacity has increased constantly. In the analysis of the ongoing projects the cost of new capacities of an integrated plant varied between regions and countries from $US 1,000 to $US 6,000.1/

1/ ESCWA. compiled from 1980 scenarios for the Iron and Steel Industry (ID/WG, 374/2. Add 1), July 1982;

- The World Iron and Steel Industry (Second Study) (UNIDO/ICIS. 89), 20 November 1976;

- Financial Situation and Perspectives of the Iron and Steel Industry (UNIDO.ID/WG.458/13), 21 February 1986. Prepared by the UNIDO secretariat for the Fourth Consultation on the Iron and Steel Industry.

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The iron and steel industry in the ESCWA region

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