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STUDY ON INDUSTRIALIZATION AND ECONOMIC CO-OPERATION FOR THE NORTH AFRICAN SUB-REGION: BASIC METALS INDUSTRY

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INTRODUCTION

The following study has been written as one of a series of studies designed to provide a framework for a programme of co-ordinated industrial development in the North African sub-region. It is not therefore written exactly on the lines on which a pre-feasibility study would be written but all the elements of such a study are included.

A. INDUSTRY DESCRIPTION

1. Production processes

(a) The basic metals industry includes the iron and steel basic industries (ISIC 341) and the non-ferrous metals basic industries (ISIC 342). These major groups and also their constituents vary greatly in the main economic characteristics i.e. raw material requirements, economies of scale, and capital and labour requirements. The iron and steel industry may be divided into the itegrated iron and steel industry which, starting from iron ore, produces iron, crude steel and rolled steel products and the rolling indsutry which produces rolled steel products from semi-manufactures of steel (billets and slabs) supplied either by the integrated industry or produced by melting down steel scrap. The production of wire and of welded tube is also included but the forging industry and also the iron casting industry, which produces iron shapes by melting down iron scrap and pouring the metal into moulds may also be included in engineering industries since they normally make finished goods rather than rough forgings and castings.

The production of iron takes place in the blast furance where iron ore is reduced to iron by means of coke, approximately half the coke being required to provide carbon for the chemical reduction of iron oxide to iron and half to provide the heat necessary for the reaction to take place. Limestone is used as a fluxto melt the charge so that metal and slag are separated. The iron produced in the blast furance is an alloy of iron and carbon containing about 4 per cent carbon and to make steel, the carbon content is brought down by oxidation to below 1.8 per cent and for mild steel to about 0.2 per cent, either directly by blowing oxygen through the molten metal or with the assistance of external heat, e.g. in the electric furnace or open hearth furnace. The liquid steel so obtained is either poured into moulds to form ingots or is cast directly into semi-finished shapes in a continuous casting machine. The ingots or semi-manufactures are then rolled into finished shapes by heating the material to make it malleable and then passing through rolls of appropriate design.

The integrated industry must be operated on a large scale with an annual output of at least 200,000 tons (see below). The scale of operation of the rolling industry depends on the type of product but reinforcing bar can be produced at a reasonable cost at an annual output of about 25,000 tons while wire drawing and tube welding can work economically on a very small scale.

(b) The non-ferrous metal industry includes aluminium, copper, lead, and zinc and their alloys, and at a much lower level of consumption, tin, magnesium and antimony as well as alloying elements such as manganese, nickel, chromium and molybdenum and the rarer metals such as beryllium. As in the case of the iron and steel industry the industry includes integrated operations as well as scrap melting, rolling, drawing and extrusion.

The methods of production of these metals differ from those used in the iron and steel industry in the following respects. Firstly, the ores usually have a much lower content e.g. 3 per cent for copper and 7-12 per cent for lead and zinc compared with 50 to 60 per cent for iron so that a major concentration process is required. Secondly, it is more difficult to separate each non-ferrous metal from others found in the same ore, so that the refining process must be repeated or interrupted. Thirdly, and in contrast to steel, the metals are normally required in a very pure state so that a final refining process either of a thermal or electrolytic character is required. Finally, although in almost all cases coke is the reducing agent and sulphur removed by pre-roasting as in iron making, the conditions of the chemical reactions involved are different. In the case of zinc for example the reaction will only take place at temperatures at which volatilization occurs so that the process is conducted either in retorts or in a blast furnace with facilities for condensing.

In the case of copper, the usual concentrate consists of copper and iron sulphide minerals (it is usual therefore to incorporate a sulphuric acid plant) and gangue and the separation of the crude copper is achieved in two stages.1/ In the first, mineral is melted with a flux to produce a matte of copper and iron sulphide free from gangue. The molten matter is then oxidized by blowing air through it which first of all eliminates iron oxide in the slag and then converts the copper sulphide to copper, the sulphur providing the heat required as carbon does in steel making. The metal is not sufficiently pure for most purposes and requires electrolytic refining.

1/ Blast furnace smelting used to be almost universal in earlier days but with the advent of concentrators and the recovery of copper into copper concentrate in a fine form the blast furnace became inefficient due to heavy dust losses and reverberatory smelting took over. There are still a few blast furnaces smelting copper concentrates but these are small operations only and the only time that the blast furnace operation could be successfully used is when production is small and the heavy capital cost of a reverberatory furnace prohibitive.

In the case of aluminium the affinity of the metal for oxygen is so great that electrolysis is used. The process requires a high purity alumina. Magnesium is produced in a similar way and where sea-water is the source, requires a major concentration process. Electrolytic methods may also be used in the case of both copper and zinc and is applied to solutions of their salts.

The rolling of the non-ferrous metals is simpler than that of steel because of their greater malleability and can be carried out at lower temperatures and for the same reason extrusion and drawing are also practicable. Sheet and foil are rolled from slabs while the sections, tubes and wire are drawn or extruded from bars. The smaller diameters being extruded. The slabs and bars are normally produced by continuous casting.

The alloying metals are mainly required in the form of alloys with iron and with the exception of high carbon ferro-manganese which is produced in the blast furnace in the same way as iron, are produced in electric furnaces.

2. World market situation

(a) World production

The following table gives figures of world basic metal production in recent years. On average, about two-thirds of steel production is derived from ore and the rest from scrap while the corresponding proportion for aluminium, copper and lead is about four-fifths. Higher proportions of scrap are used in the developed countries since scrap is more abundant.

About 95 per cent of total basic metal consumption consists of steel which offers, in addition, the main market for the alloying and coating metals. From 1955-59 to 1964 world production/consumption increased by 53 per cent i.e. by 6.3 per cent per annum during which period the world GDP increased by about 5.0 per cent per annum. Steel experiences competition mainly from aluminium and plastics and to a lesser extent from wood and glass and it is estimated that about 6 per cent of potential steel usage has already been replaced by these materials. A further one per cent of steel consumption is considered vulnerable to aluminium at present and a further half per cent to plastics. Forecasts of future steel consumption have been made by ECE assuming a continuation of the rate of growth (5.6 per cent per annum) achieved from 1950 to 1965 and by UNCTAD which has projected a rate of growth of 5.0 per cent 1/ for the period 1964-75 reflecting the expected lower rate of growth in the world GDP (4.4 per cent per annum.)

World aluminium production/consumption increased by 74 per cent from 1955/59 to 1964 i.e. by 8.2 per cent per annum, this higher rate of increase resulting from the replacement of steel and copper in many uses, aluminium having the advantage of low density, resistance to corrosion, high electrical conductivity and stable prices. It has been estimated that in the past

1/ A later study by UNCTAD proposes 3 per cent.

Table 1 : World production of basic metals ('000 long tons = 1016 metric)

	1958/9	1960	1961	1962	1963	1964	1965
Steel	279987	340702	345427	353851	380080	429655	436300
Aluminium d/	3445	4424	4631	4985	5423	6004	6624
Copper c/	4000 a/	4927	5045	5184	5306	5672	6047
Lead c/	2155	2595	2772	2734	2901	3008	3123
Zinc c/	2751	3029	3288	3412	3517	3795	3972
Tin c/	181	227	202	204	204	205	205
Magnesium	90	92	104	132	144	149	156
Antimony	50	52	51	53	55	61	62
Chromite b/	3961	4360	4158	4301	3893	4298	4823
Nickel	255	316	355	350	345	376	420
Manganese ore b/	11997	13380	13365	14047	14527	15568	17334
Molybdenum	32	40	40	34	41	42	51
GDP 1958 = 100	98	113	117	124	129	138	146

Source: World non-ferrous metal statistics and United Nations Statistical Yearbook.

a/ Estimate.

b/ Approximately 50 per cent metal content.

c/ Refined: in 1964 primary production was copper 4700, lead 2600, zinc 4000, tin 199.

d/ Excluding secondary = 1 million tons in 1964.

a one per cent decrease in the ratio of the price of the metal to the composite price of copper, lead and zinc has increased its consumption by 1.4 per cent. UNCTAD has forecast an annual rate of increase of 8.0 per cent in consumption for the period 1964-75.

World production/consumption of refined copper increased by 43 per cent (primary copper by 35 per cent) from 1955-59 to 1964 i.e. by 5.2 per cent per annum, a rate lower than that of steel consumption reflecting competition from aluminium and also probably the relatively unstable price of the metal. During 1961-65 production increased by 4.7 per cent per annum and consumption by 5.0 per cent. The main outlet for the metal is in power transmission and electrical wiring generally and heat transfer becasue of its exceptionally high conductivity while other uses depend on its resistance to corrosion. For the period 1964-75 UNCTAD has forecast a rate of growth of 5.0 per cent.

World zinc production increased by 39 per cent - 48 per cent per annum from 1955-59 to 1964, while during 1961-65 production increased at the annual rate of 47 per cent and consumption at 5.2 per cent. Major outlets are in galvanizing and in dye casting for which purpose there are no serious direct competitors. The UNCTAD projection is 4.1 per cent per annum increase from 1964-75.

World production of refined lead increased by 40 per cent - 4.9 per cent per annum - from 1955-59 to 1964 and of primary lead by 12 per cent - 1.7 per cent per annum. Since lead is virtually indestructible, secondary lead is a major source of supply. Half the market for the metal is in storage batteries and gasoline additives where competition is negligible but in other uses the market is being lost to plastics and other metals. From 1961-65 production of refined lead increased at the annual rate of 2.8 per cent and consumption by 4.2 per cent. UNCTAD has forecast a rate of 3.3 per cent for primary lead for the period 1967-75.

World tin production increased by 13 per cent - 1.8 per cent per annum for 1955-59 to 1964 and by 1.4 per cent per annum during 1961-65. The major use of tin, in tin plate and other uses such as solder and tin foil are vulnerable to many materials. UNCTAD has forecast a rate of growth of 11 per cent per annum for primary tin consumption for 1964-75.

(b) Production and international trade

Steel production is widely spread, some fifty countries producing it on some scale and 30 countries producing over a million tons a year. As shown in the following table the main areas of production are in the industrialized countries, the under-developed countries accounting at present for only about 4 per cent of the world total although they account for about 11 per cent of world iron ore production.

Table : 2 World Steel Production

(million tons)

	Europe	USA	Japan	Centrally Planned economies	Australia Canada and S. Africa	Rest of world	Total
1953	61.8	99.7	7.5	51.7	6.7	3.5	231.0
1957	89.2	100.6	12.4	71.3	9.0	5.6	288.0
1963	107.2	97.6	31.0	113.1	14.2	13.8	376.9

This pattern of development is reflected in international trade where although steel production has increased by about one-third since 1957, world exports, excluding inter-trading among the countries of the European Coal and Steel Community have remained constant at about 25 million tons per annum largely because of declining exports to the developing countries and to Australia, Canada and South Africa. Exports of steel from under-developed countries are at present negligible, only India and Brazil exporting small quantities. In contrast to the relative stagnation of exports of steel, world exports of engineering goods are expanding rapidly, exports from the six principal exporting countries of the world increasing in value by nearly 40 per cent from 1960 to 1964 while their exports of steel increased in value by only about 15 per cent.

In the case of the non-ferrous metals although consumption as in iron and steel is mainly in the developed countries (90-95 per cent of the total) the production of metal and of ores in developing countries is in general carried on to a much greater extent than in the steel industry. For aluminium (Annex 1), consumption and production in developing countries in 1964 accounted for only 5 per cent of world consumption but current developments in Surinam, Ghana and Guinea will greatly increase production. The production of ore (bauxite), which has always been mainly in developing countries now accounts for 78 per cent of the world total as compared with about 22 per cent in the case of iron ore. This is reflected in the high proportion, about one half, of bauxite which enters into international trade (cf. 1/3 iron ore).

A fairly high proportion also, about 25 per cent, of aluminium enters into world trade largely because certain countries with special facilities in electric power or raw material for production e.g. Canada, Norway, Cameroon export 80 per cent or more of their output. On the other hand, exports of semi-manufactures which are equivalent to rolled products in the case of steel are low amounting to only 8 per cent of world production as compared with 12 per cent in the case of steel.

In the case of refined copper, developing countries account for 6 per cent of world consumption but for 23 per cent of production and for about half the production of ore. Zambia, Congo, Chile, and Peru are the major

producers among the developing countries. Because of the pattern of production and consumption, international trade in copper is at a higher level accounting for about 40 per cent of production, exports coming mainly from the developing countries and from Canada and Belgium while only about 6 per cent of copper ore production enters into international trade.

In the case of lead, developing countries account for 10 per cent of world consumption, 19 per cent of production and 36 per cent of world output of ore. Important producers among the developing countries are Mexico, Peru, Yugoslavia and North Africa. The main exporters of the metal are Canada and Australia which have large reserves of ore, the United Kingdom and Belgium, and the developing countries. The position of zinc is similar to that of lead, developing countries accounting for about 10 per cent of world consumption and production of metal and for about 30 per cent of the output of ore.

The tin industry is carried on mainly in developing countries, notably Malaya and Nigeria and in the United Kingdom, Belgium and the Netherlands. Developing countries account for only 10 per cent of world consumption but produce 65 per cent of the metal and 94 per cent of the ore.

(c) Prices

The following table gives market prices of the main non-ferrous metals as far as possible in their primary form, i.e. steel billets, aluminium ingots and refined copper, zinc and lead. The prices of all the metals with the exception of copper and tin, which have been affected by interruptions to supply and shortages largely of a political character, have been remarkably stable.

Table 3 : World market prices of basic metals

Cents/lb

	Steel	Aluminium	Copper[a/]		Lead	Zinc	Tin	Ferro-manganese
1955/59	4.0	22.9	32.9	33.2	11.7	10.4	95	..
1960	4.1	23.3	30.7	32.1	9.2	11.3	100	..
1961	4.1	23.3	28.7	29.9	8.0	9.7	111	6.4
1962	4.0	22.6	29.2	30.6	7.0	8.4	112	6.1
1963	4.0	22.6	29.2	30.6	7.9	9.6	114	5.9
1964	4.0	23.9	43.9	32.0	12.6	14.7	156	5.8
1965	4.0	24.5	58.0	35.0	14.4	14.1	176	6.0
1966	4.0	24.5	69.4	36.2	11.9	12.7	162	6.4

Source: Engineering and Mining Journal, Annual Survey 1967.

a/ US domestic price.

3. Input requirements

The following section gives standard input requirements for the manufacture of iron and steel and of ferro-manganese, aluminium, alumina, copper, lead and zinc in new plants, writing off machinery over twenty years and buildings over fifty years at 8 per cent interest. The prices used are broadly representative of North African conditions but a more exact treatment of prices and costs including transport costs is given in Section E below in connexion with the comparison of costs of production in the various countries. Input requirements for these industries in their present state of development that is in most cases using small-scale technology and relatively old plants are also given in Section C.

In general iron ore prices are fairly stable, an increase in the price of the metal being only partly reflected in the price of ore so that the price of the metal is obtained by adding ore prices to manufacturing costs. For the non-ferrous metals however, where the price of ore is a much more important constituent of metal prices it is the practice to derive the market price of ore (concentrate) from that of the metal after allowing for manufacturing costs. Moreover, in some cases the rarer metals obtained in the course of processing e.g. silver in the case of lead processing may be sufficiently valuable to offset processing costs entirely.

(a) Iron and steel

The practical possibilities are integrated iron and steel manufacture, scrap melting, steel rolling and foundry production. In the table overleaf which broadly reflects North African conditions, integrated iron and steel manufacture is taken as far as and including continuous casting; rolling is shown separately. Transport charges on raw materials are taken over average distances for the sub-region. In estimating labour requirements, productivity at a new works is taken as equal to productivity in average European works or about half that at average works in the United States. Wages are average for the North African region and capital required per unit output is about one-third higher than in Europe.

(b) Non-ferrous metals

In the case of non-ferrous metals the value of the concentrate is a much higher proportion of the value of the finished product than it is in iron and steel. This is especially so for copper, where the value of the ore in the form of concentrate accounts for between 75-80 per cent of the value of the copper ingot e.g. about 25 cents per lb as compared with 33 per cent or 5 cents per lb for the alumina content in aluminium and about 10 per cent for the iron ore content of steel ingots. The cost of smelting copper is about 13 per cent and of electrolytic refining, about 7 per cent of the value of the ingot - in total about 20 per cent or 6 cents per lb as compared with 20 cents per lb for aluminium smelting. It is clear therefore that in regard to copper the concentration process is the main one in producing refined copper. In the case of lead and zinc, the concentrate accounts for approximately 4 cents per lb of the finished product while conversion costs are about 5 cents per lb. In comparison with these figures the cost of melting scrap metal is approximately 2 cents per lb.

Table 4 : Costs of production - iron and steel and ferro-manganese

( ) qty. per ton of product $ per metric ton

(a) Iron and Steel

Product	Integrated Iron and steel continuous cast billet	Rolling bar cold sheet	Scrap melting and rolling bar	Welded tubes	Wire drawing
Scale of operation	500,000 tpa ...	100.000.....		20,000.....	
Materials					
Iron ore	(1.6) 7.8	-	-	-	-
Scrap @ $20 per ton[a]	(0.2) 4.0	-	(1.1) 22.0	-	-
Limestone[b] ex mine @ $2 per ton	(0.3) 0.8	-	(0.1) 0.3	-	-
Manganese ore[c]	(0.006)	..... steel			
Imported @ $50 per ton	0.3	billets (1.05) 74.0	slabs (1.1) 77.0	- -	sheet (1.05) 57.5	rod (1.05) 110.0
Ferro-alloys	2.0		2.0		
Refractories	5.0		6.0		
Spare parts and other maintenance mats.	5.0	1.0	2.0	6.0		
Water c/	1.0				
Total materials	25.9	75.0	79.0	36.3	157.5	110.0
Fuel and Energy						
Assuming 25 per cent oil injection & oxygen steel making						
Coke-(One-third ore + limestone = 0.63 tons) imported to coastal works @ $25 per ton	15.7	-	-	-	-	-
Fuel oil ($\frac{1}{4}$ coke)		(0.1) ton 1.0	(0.2) ton 2.0	(0.1) ton 2.0	-	-
Imported or local plus transport @ $20 per ton	3.2					

Table 4 (cont'd)

Electricity (120 kWh) @2 cents per unit	2.4	2.4	14.4	18.0	2.0	4.0
Total fuel & energy	21.3	4.4	8.4	22.0	2.0 (electrodes)	4.0
Wages	(8) g/	(8) g/	(14) g/	(15) g/	(8) g/	(12) g/
@ average wage per hour f/ $0.8 including social charges	6.4	6.4	11.2	12.0	6.4	9.6
Overheads e/ @3% on sales	2.0	3.0	4.0	3.0	5.0	4.0
Capital charges (writing off @ 8%)						
Building etc. (50 yrs) = 8.2%	on $50=4.1	on $55=4.5	On $150=12.3	on $75=6.1	on $25=2.0	on $30=2.4
Machinery (20yrs) =10.2%	on $100=10.2	on $80=8.2	on $250=25.4	on $125=12.5	on $50=5.1	on $80=8.2
Working capital (3 months) = 8%	$17=1.4	$26=2.1	$38=3.0	$25=2.0	$45=3.6	$35=2.8
Total cost	$72	$104	$142	$94	$180	$142

a/ Assuming scrap accounts for about 20 per cent of the metallic charge to the converter. Of this quantity about 2 per cent would be available from the steel making process, about 2 per cent from casting and about 6 per cent from rolling so that the net requirements to be bought would be about 10 per cent. Alternatively ore may be used instead of bought scrap. The position in these two cases would be as follows:

	10% bought scrap	No bought scrap
Production of finished steel	100	100
Liquid steel required	111	111
Scrap available		
Process 10		10
bought 10	20	
Ore	—	4(2Fe)
Iron required	94 Fe	100Fe
(3% iron lost in dust and slag and using 60% ore: ore required)	161	172 + 4 = 176

b/ Limestone requirement equals twice lime. Lime requirement equals 1¼ silica plus lime for steel making (.06 per ton crude steel or 07 finished) Total for ore of 5% silica equals 12½% limestone plus 0.7 and for 10% silica 25 per cent limestone plus .07.

c/ Assuming no manganese in iron ore.

d/ Assuming 20 m^3 per ton in steel making @5 cents per m^3

e/ Insurance, telephone printing, etc.

f/ 25 per cent @1.8, 40 per cent @ $0.6, 35 per cent @ $0.4.

g/ Man-hours per ton.

Costs of Production

(b) Ferro manganese:

Scale	45,000 t.p.a.
	$ per ton
Ore (2 tons) @ $16	$32
Coke (0.6 tons) @ $25	$15
Limestone (0.3 tons) @ $3	$ 1
Electrodes (0.03 tons) @ $100	$ 3
Electricity (3,200 kwh) @ 0.5 cents	$16
Scrap (0.05 tons) @ $30	$ 1.5
Maintenance materials	$ 5.0
Overheads @ $ per cent on sales	$ 6.0
Labour (5 man hours per ton)	$ 4.0
Capital: fixed $130	$12
working $30	$ 2.4
Total	$98
Current prices	$130

(c) Alumina and aluminium

Product	Alumina		Aluminium ingot	
Scale of operation	200,000 t.p.a.		100,000t.p.a.	
	$ per ton			
Ore: Bauxite (2 1/3 ton) @ $3 per ton	7.5		Alumina(1.9 ton) @ $60	114
Transport to alumina plant	?		Transport to alumina plant?	
			electrodes	
Caustic soda (0.4 ton) @ $100 per ton	4.0		Carbon/(0.55 ton) @ $75	42.0
Fuel oil (0.32 ton) @ $20 per ton	6.4		Electrolyte (0.05 ton) @ $330	16.5
Electricity (200 kWh) @ 0.3 cents	0.6		Electricity (16,500 kWh) @ 0.3 cents	49.5
Repairs and maintenance and misc. material	5.0		Repairs & maintenance	10.0
Overheads @ 5% on sales	2.5		Overheads @ 5% sales	18.5
Labour (@ 15 man hours per ton) @ $0 .8	12.0		Labour (@ 35 Man-hours per ton) @ $0.8	29.0
Capital charges 9 per cent on $160	14.4		Capital charges 9% on 700	63.0
Total	52			342.0

Indicated

Costs of production

(d) Copper

Product	Refined copper
Scale of operation	50,000 t.p.a.
	$ per ton metal
Price of metal	800 (920) US max. controlled price
Costs of production	
Silica flux: (0.6 tons) @ $5	$3.0
Fuel oil: (0.5 tons) @ $20	$10.0
Power: Smelter (600 kWh. @ 2 cents)	$12.0
Refinery (250 kWh. @ 2 cents)	$ 5.0
Labour: Smelter (6 mh. @ $1)	$ 6.0
Refinery (4 mh.@ $1)	$ 4.0
Maintenance and misc. materials: @ $5.0	$ 5.0
Refractories	$ 5.0
Overheads: (5% on sales)	$41.0
Total	$91.0
Capital charges: @ 9% on $900[a]	$81.0 (@ 22% of $198)
Less credits on sulphur: 1 ton @ $20	$20.0
Total	$152.0
Price of concentrate at works	648

a/ Smelter $450
Refinery $200
Sulphuric acid Plant $250

Indicated

Cost of production

(e) Lead and zinc

Product	Lead and zinc
Scale of operation	50,000 t.p.a.
Price of metal	$ per ton metal $275
Cost of production	
Coke:	$ 25.0
Other fuel and energy:	$ 5.0
Maintenance and misc. materials	$ 5.0
Refractories	$ 5.0
Labour	$ 10.0
Overheads:	$ 13.0
Capital charges: 9% on $900	$ 81.0
Total	$144.0
Price of concentrate at works	$131

(f)

Product	Aluminium sheet and strip from slabs
Scale of operation	25,000 t.p.a.
Cost of production	$ per ton
Slab	$450.0
Labour: 80 man hours	80.0
Electricity: 380 kWh @ 2 cents	7.6
Capital charges: 9% on $400	36.0
Other: 5 per cent	30.0
Total	600 approx.

(g) Product: Aluminium foil from cold rolled sheet

Scale of operation	3,000 t.p.a.
Cost of production	$ per ton
Sheet	600
Labour: 300 man hours	300
Electricity: 3000 kWh	60
Capital charges: 9% on $500	45
Other 5%	50
Total	1050 approx.

(h) Product: Drawn and extruded wire, tube, sections of aluminium

Scale of operation	30,000 t.p.a.
Cost of production	$ per ton
Bar	450
Labour: 100 man-hours	100
Electricity: 900 kWh	18
Capital charges: 9% on $200	18
Other:	20
Total	600 approx.

(i) Product: Drawn wire, tubes and sections of copper

Scale of operation	70,000 t.p.a.
Cost of production	$ per ton
Bar	850
Labour: 20 man hours	20
Capital charges: 9% on $80	7
Other:	25
Total	900 approx.

4. Scale of operation

In general, investment in metallurgical operation follows the 0.6 rule, an increase of 10 per cent in capacity requiring only a 6 per cent increase in investment. Labour requirements are either independent of scale as in the operating departments or proportional to investment as in the maintenance departments or in between as in many service requirements. (Table overleaf).

In general, labour requirements fall off more rapidly than capital requirements with increasing scale of operation. Material requirements are broadly proportionate to scale of output with the exception of fuel.

Where the available market does not allow large outputs, the possibility may be examined of alternative techniques e.g. in iron smelting, the electric furnace as opposed to the blast furnace. At outputs of 50,000 t.p.a. the cost per ton of making iron in a blast furnace is nearly twice as high as at an output of 300,000 tons. The comparative position is indicated overleaf. Broadly speaking, apart from capital costs, the advantage of the electric furnace is in being able to use inferior fuel. If this is not available and coke of the same quality as for blast furnace purposes has to be used then electricity would have to be available at a cost of about 0.5 cents per unit to be competitive.

In non-ferrous metals, the alternatives in the case of copper and zinc are leaching and electrolysis which are smaller-scale processes.

Table 5 : Economies of scale

(a) Integrated iron and steel including rolling

(1) Investment

Capacity '000 t.p.a.	50	100	200	300	500	1000	1500
Fixed capital investment per annual ton							
Iron and steel including casting	350	265	200	175	150	120	110
Rolling: bar and rod	155	125	100	90	75	65	60
Hot rolled sheet	410	240	140	100	80	60	50
Cold reduced sheet	185	160	140	130	128	128	128
Integrated bar and rod: building, civil engineering and services	240	170	110	90	75	60	50
Plant and equipment	265	220	190	175	150	125	115

Table 5 (cont'd)

(a) Integrated iron and steel including rolling

(2) Labour:

Man-hours per ton							
Iron and steel	20	14	10	9	8	7	7
Bar and rod	16	8	6	5½	5	5	5
Hot rolled sheet	16	6	5	4	3	3	3
Cold reduced sheet	12	8	6	6	5	5	5

(3) Cost per annual ton $

Capital charges @ 10%							
Iron and steel	35.0	26.5	20.0	175	15.0	12.0	105
Bar and rod	15.5	12.5	10.0	9.0	7.5	6.5	6.0
Hot rolled sheet	41.0	24.0	14.0	10.0	8.0	6.0	5.0
Cold reduced sheet	18.5	16.0	14.0	13.0	12.8	12.8	12.7
Wages: @ $0.8 per man-hour:							
Iron and steel	16.0	11.2	8.0	7.2	6.4	6.4	6.4
Bar and rod	12.8	6.4	4.8	4.4	4.0	4.0	4.0
Hot rolled sheet	12.8	6.4	4.0	3.2	2.4	2.4	2.4
Cold reduced sheet	9.6	6.4	4.8	4.8	4.0	4.0	4.0
Materials and fuel and overheads							
Iron and steel	75.0	62.2	56.2	56.6	51.3	51.0	51.0
(of which coke, fuel oil and ore)	28.0	27.9	27.8	27.6	27.6	27.5	27.5
Bar and rod	10.0	0	8.8	8.4	7.9	7.8	7.8
Hot rolled sheet	10.0	7.0	4.9	4.2	3.5	3.3	3.2
Cold reduced sheet	8.0	7.0	6.3	6.0	5.7	5.7	5.7
Total: integrated bar and rod	170.6	132.8	112.1	103.0	95.8	91.2	89.1

(b) Iron making in blast furnace and in electric furnace at capacity of 50,000 tons per annum

1. Investment

	Blast furnace	Electric furnace
	150	120
2. Cost per annual ton		
Capital charges @ 9%	13.5	10.8
Coke/coal/ oil	25.0	6.0 ½ ton inferior coal
Electricity	3.0 @ 2 cents/ kWh	2,000 kWh = $40 @ 2 cents = $20 @ 1 cent
Other charges	20.0	20.0 + electrodes $5
Total	61.5	81.8 or 61.8

5. Transportation costs

A variety of information has been noted on transport costs which requires further analysis. For Morocco the average transport costs in 1965 for all merchandise carried by rail and over an average distance of 130 km was 1.2 cents per ton/km, the actual rates varying from one cent per ton/km plus handling, i.e. loading and unloading, for minerals to 1.8 cents per ton/km plus handling charges of from 60 to 120 cents per ton for other merchandise. Dividing the transport costs into running costs and terminal costs, i.e. assembly, in accordance with European practice, the above figures suggest the following estimates.

Table 6 : Estimated railway rates in Morocco

(cents)

	Handling per ton	Terminal per ton	Running per ton/km
Minerals, i.e. ore and coal	10	50	0.8
Other goods, e.g. steel	40	80	1.2

A corresponding analysis of some UAR rates suggests the following position.

Table 7 : Estimated railway rates in UAR

(cents)

	Handling per ton	Terminal per ton	Running per ton/km
Iron ore	10	40	0.2
Coal	20	70	0.3
Iron and steel	40	80	0.4

The rates especially for minerals appear to be heavily subsidized.

In Algeria, on the other hand, average rates are two cents per ton/km, almost twice those in Morocco. The Morocco rates are close to European rates and may perhaps be regarded as normal although in any particular case account would also have to be taken of other factors, e.g., the possibility of return loads.

The differentials for sea and road traffic may be estimated using the normal relations between terminal and running costs.

Table 8 : Estimated road and sea rates

(cents)

	Sea			Road[a/]		
	Handling per ton	Terminal per ton	Running per ton/km	Handling per ton	Terminal per ton	Running per ton/km
Iron ore	150 (75)	300(150)	0.05(.08)	(10)	-	1.8
Steel	350 (175)	600(300)	0.05(.08)	(40)	-	1.8

a/ Excluding cost of road.

A differential may also be established between transport costs on ocean going ships, say, ten thousand tons and above and on coastal steamers of two thousand tons or less. The larger ships will have lower running costs but higher terminal costs because of the longer time required for loading and unloading and higher handling costs because of the greater distance through which cargo is transferred.

6. Wages and labour

At the integrated iron and steel works in Tunis in 1966, the average wage cost for all persons employed was 0.8 dollars per man hour.

Figures are available of average wages and numbers employed in the iron and steel and in the non-ferrous industries in Algeria in 1964. The average hours worked in the iron and steel industry per operative in 1964 was 1,000 giving an average wage of 1.15 dollars per man hour. The average wage for all employees was probably about 25 per cent higher.

In the non-ferrous industry, the average wage for operatives was 0.8 dollars per hour and for all employees, about 15 per cent higher.

For Morocco average wages include social charges for all employees in 1964 are available from the input-output tables as follows:

	$ Per annum	$ Per ton
Lead production	1710	0.71
Wire drawing: ferrous	1810	0.75
non ferrous	1980	0.82
Foundry	1530	0.64

Table 9 : Average wages and numbers employed in Algeria in 1964

	Iron and Steel Industry			Non-ferrous industry		
	No.	%	Av. annual wage	No.	%	Av. annual wage
Administrative	19	4	$4,880	6	1	$4,000
Technicians	10	2	4,430	6	1	4,400
Foremen	15	3	3,030	19	2	3,200
Clerical, etc.	84	15	2,470	23	3	2.500
Operatives	431	76	1,100	819	93	1,100
Total	559	100		873	100	

Wages in the UAR are considerably lower than in the Maghreb countries and are estimated to be as follows.

Table 10 : Estimated wages in the iron and steel industry in the UAR

	Annual wage
Administrative	$2,300
Technical	1,600
Foreman	600
Operatives: skilled	500
unskilled	350

Average: 50 cents per man hours.

The classification of labour in a modern integrated iron and steel works is as follows:

		Per cent
Managers and senior technicians		4
Junior technicians:	Foremen	4
	Technical	4
	Clerical	8
	General	10
Skilled operatives: and semi-skilled	Craftsmen i.e. welders, bricklayers, fitters, joiners, electricians	11
	Other maintenance workers and repairers	8
	Drivers and transport	5
	Production operatives	30
Unskilled operatives	Labourers and Cleaners	16
	Total	100

The managerial category may be further classified as follows:

Managers and Assistants		15
Engineers:	Mechanical	12
	Electrical	5
	Chemical	8
	Metallurgy	10
	Design	13
Clerical:	Secretaries	13
	Accountant and commercial	18
Miscellaneous:		6
	Total	100

The wages obtaining in North Africa are more or less typical of African conditions as far as those of the operative class are concerned but are much lower than those required to attract expatriate staff which would be reckoned at about $14,000 for senior management and $5000 for junior technical and foremen grades.

7. Energy

The coal situation is referred to below and petroleum which may be used to reduce coke requirements in iron making is produced in quantity in Algeria, UAR and Libya. Current prices of electricity are given in the following extract from the 'Preliminary report on the ECA mission to six countries of the North African sub-region' for various types of industrial consumers:

Type I: Small-scale industry with a yearly consumption of 30,000 kWh and a maximum peak load of 40 kW.

Type II: Medium-scale industry; 500,000 kWh p.a., 250 kW.

Type III: Relatively large-scale industry; 5 GWh p.a., 1.2. MW,

Type IV: Large-scale industry; 100 GWh p.a., 15 MW.

Table 11 : Energy prices in centimes NF/KWh

Country	Type of industrial consumer			
	I	II	III	IV
Algeria	17.20	11.70	8.40	5.60 = 1 cent
Morocco	20.80	13.20	9.10	7.70 = 1.5 "
Tunisia	18.10	14.70	13.10	12.80 = 2.5 "

The energy prices given above are much higher than, for example, those in Europe. The excess over prices in France is:

Algeria	about 20 per cent
Morocco	about 30 per cent
Tunisia	about 65 per cent

The reasons for these high energy prices are manifold, the most important being as follows:

(i) In Algeria and Tunisia, less than 50 per cent of the available energy potential is consumed;

(ii) In Morocco, hydro-power stations are by far the most important energy producers. Because of relatively poor hydraulicity (200-800 mm p.a.) and because the water is also used for agricultural purposes, the installed power in the stations is fully utilized: about 3,500 hours p.a. in the years with good hydraulicity and only about 2,600 hours p.a. when hydraulicity is poor. The energy costs are therefore relatively high;

(iii) Morocco and Algeria have extremely long coastlines and the ratio of the length of the high-voltage transmission lines to the yearly production is four to six times greater than in European countries.

No information is given on prices in UAR but it is understood that with the completion of the Aswan scheme, electricity may be available to large users at prices comparable with those charged in other countries benefiting from large hydro-electric resources e.g. Rhodesia, Uganda, Ghana where rate of 0.2 cents per unit have been quoted. Whether such a rate could be maintained however in UAR with rapidly increasing demand is uncertain. In other countries e.g. Libya the relatively small size of the electricity generating plants keeps prices high in spite of the availability of cheap fuel.

B. PRESENT SITUATION AND RECENT DEVELOPMENT OF THE INDUSTRY

It is convenient to give first of all a general description of the present basic metal industry country by country and then a statistical analysis.

(a) General description

Morocco

1. Iron and steel

The basic iron and steel industry of Morocco consists at present only of wire drawing works; there is no integrated iron and steel making or steel rolling either with or without scrap melting. There are numerous foundries and forges which are included also under the engineering industry.

In the 1960-64 plan it was proposed to establish a scrap melting and rolling mill at a cost of about $300 per annual ton with an output of 60,000 tons mainly of reinforcing bars. Local scrap was considered adequate, as is the market, but this plan was abandoned. Other proposals in the 1960-64 plan which did not materialize, included the establishment of a ferro-manganese plant with an annual output for export of 20,000 tons and at a capital cost of $240 per ton. Current supplies of local ore of metallurgical quality were estimated at 200,000 tons per annum but reserves are steadily declining. Another proposal was to manufacture welded and galvanized steel tubes for the local market. The capacity of the plant was to be 7,000 tons and the capital cost $170 per ton. The 1970 government projections include the steel tube plant and an extension of wire drawing capacity to 5,000 tons per annum.

In the 1965-67 plan, three alternative steel developments were outlined. Firstly a rolling mill based on imported billets. Secondly a rolling mill based on scrap melting. And thirdly, an integrated iron and steel plant. The location proposed for either of the first two was Casablanca which offers both the largest market for finished steel and the largest supply of scrap.

Location for the integrated works was at Nador on the coast near the ore fields and near the port (Melilla) for iron ore exports. It was realized however that the economic scale of the integrated plant was likely to be of greater capacity than the domestic market would justify. It is understood that a decision has now been taken in favour of the integrated iron and steel plant. In arriving at this decision account has been taken of the present position in regard to reserves of iron ore. It is now considered that the only substantial reserves of iron ore in the country are those in the vicinity of the proposed plant, namely the Uixan/Setolazar deposits and that total reserves available at this source from 1970 onwards will amount to about 25 million tons. It is proposed to extract these at the rate of one million tons per annum giving about 860,000 tons of pellets of which 460,000 tons would be exported and 400,000 delivered to the proposed steel works at a price of about $10 per ton. This would give 250,000 tons of iron and 180,000 tons of steel. Presumably exports of scrap from Casablanca will continue. The capacity of the iron and steel foundries is round 8,000 tons per annum.

2. Non-ferrous metals

(a) Aluminium

Aluminium rolling from imported plate is carried on to the extent of about 400 tons per annum. In the 1960-64 plan it was proposed to extend the re-rolling capacity to about 1,000 tons per annum including both sheet and foil at a capital investment of about $400 per annual ton and an employment of 240 man hours per ton. The present 1970 projection is for a capacity of 500 tons. There are no bauxite deposits.

(b) Lead/Zinc

Approximately 100,000 tons of lead concentrate (70,000 metal content) are exported annually and 20,000 tons delivered to the Oued-El-Heimer foundry. All zinc concentrate, about 90,000 tons (45,000 metal content) is exported. In the 1960-64 plan, although reserves of lead ore are adequate, it was proposed, because of international restrictions on production, not to extend the Oued-El-Heimer foundry beyond its present capacity of 32,000 tons per annum. AT the same time, however, it was proposed to treat mixed lead and zinc ores in a new furnace with an annual capacity of 30,000 tons zinc and 20,000 tons lead. This proposal is retained in the 1965-67 plan where it is estimated that the capital cost would be $400 per annual ton and employment 17 man hours per ton. It is considered however that domestic zinc ore reserves will not be adequate and it will be necessary to rely on other North African sources.

(c) Copper

It is estimated that present supplies of copper ore amount to about 6,000 tons per annum copper content which could possibly be raised to 10,000 tons per annum. A small foundry or alternatively electrolytic extraction of the metal has been proposed.

(d) Scrap processing

A plant of about 750 tons per annum capacity for refining non-ferrous scrap is in production.

Algeria

1. Iron and steel

The basic iron and steel industry of Algeria consists at present of a scrap melting unit at Oran, producing reinforcing bar and with a melting capacity of 30,000 tons per annum and a rolling capacity of 40,000 tons per annum. In addition, there is a welded tube plant of about 25,000 tons capacity based on imported semis and wire drawing capacity of 8,000 tons. Production in recent years has been at about one-third capacity.

The main current development is the erection of the integrated iron and steel works at El Hadur on the coast near Annaba (Bone). This will have a capacity of between 3.400,000 tons of flat products. Construction started in April 1966 and under the present programme the blast furnaces should be completed end 1968, the steel plant end 1969 and the hot strip mill in 1970. It is probable that galvanized sheet, tin plate and welded tubes will also be made. It is estimated that 2,700 km. of oil tubing will be required. Iron ore will come from the Ouenza deposit, 160 kilometres by rail south of Annaba where reserves are estimated at about 130 million tons of 54 per cent Fe. Production from this deposit has ranged from 2 million tons in 1962 to 2,740,000 in 1964 and 1 million tons of the lower grades will supply the new steel works. The other major deposit in Algeria is at Gara Dejebilet, 130 kilometres south-east of Tindouf where reserves are estimated at 765 million tons at 58 per cent Fe. Coal with some coking qualities is available at Colomb Becher (30 million tons) and at Abadla (1,000 million tons).

The capacity of the iron and steel foundries is around 18,000 tons per annum and about 4,000 tons were produced in 1963.

2. Non-ferrous metals

Aluminium rolling from imported semis is carried on in a plant with a capacity of 600 tons per annum. Copper wire and aluminium wire is drawn from imported rod in plants of capacities of 6,000 tons per annum and 2,000 tons per annum respectively. Lead tubes and lead sheet are manufactured in plants of capacity 3,500 tons per annum. Scrap melting (refining) of aluminium, zinc, copper and lead is carried on to a capacity of about 2,500 tons per annum and small quantities are exported.

The annual production of lead concentrate amounts to about 13,000 tons (9,000 metal content) and of zinc concentrate 60,000 tons, (37,000 metal content) all for export.

Tunisia

1. Iron and steel

The Manzel Bourgiba integrated iron and steel works came into production in 1966 when 36,000 tons of finished steel were produced. Production in 1967 is estimated at 70,000 tons. The capacity of the blast furance is 150,000 tons per annum and of the rolling mills 100,000 tons per annum. Iron ore comes from the Djerissa mine, about 200 kilometres distant, where reserves are estimated at 32 million tons of 56 per cent Fe and output has averaged about 900,000 tons per annum. Other deposits are at Tamara, about 12 million tons and at Djebl Ank, south of Djerissa, which is believed to contain 30 million tons of 53 per cent Fe.

Foundry production in 1966 amounted to about 4,000 tons. With the construction of the arsenal foundry (capacity of 2,800 tons iron and 3,800 tons steel) and with extensions elsewhere, capacity by the end of 1968 is expected to reach 12,000 tons. Wire drawing including screws and bolts and tube welding is envisaged at about 8,000 tons and 6,000 tons annual capacity respectively.

2. Non-ferrous metals

Both lead and zinc ore are mined and concentrated giving in 1965 about 25,000 tons (16,000 metal content) and 7,500 tons (4,000 metal content) respectively of concentrate. Most of the lead concentrate is processed in the foundry at Tunis which has a capacity of 30,000 tons per annum of lead but produced in 1966 only 14,000 tons because of the shortage of concentrate. Silver for traditional industry is a useful by-product. Lead tubes are manufactured in a plant of 3,000 tons per annum capacity, present production being 1,000 tons and miscellaneous lead products including oxide and lead for hunting and fishing amount to about 250 tons per annum. Zinc oxide is manufactured in a plant of capacity 600 tons per annum by volatilization of the concentrate.

Libya

1. There is a small production of reinforcing bar based on rails and billets, and scrap melting will be started when scrap availabilities are large enough. Reserves of iron ore in the Fezzan region are estimated at 720 million tons of 48 per cent Fe but are 600 kilometres from the coast.

United Arab Republic

1. Iron and steel

Iron and steel making facilities in the UAR are relatively advanced. The main unit is the integrated works at Helwan with a finished steel capacity of 200,000 tons per annum producing flat products as well as light and medium sections. Other units include three semi-integrated plants with

a capacity of 180,000 tons per annum in round bars. It is proposed to expand the capacity of the Helwan works to 1.5 million tons per annum ingot steel and to include a strip mill already under construction with an ultimate capacity of 700,000 tons per annum finished products. The plant will use oxygen steel making and continuous casting. The establishment of a second integrated plant is contemplated at Aswan with a capacity of 400,000 tons per annum in round bars and comprising electric reduction, oxygen steel making, continuous casting and a fully continuous bar mill. A wide plate mill of 200,000 tons per annum capacity and based on slabs from Helwan is under study and might form the nucleus of a third integrated works. The existing semi-integrated plant intend to double their capacity and one of them will specialize in special alloy steels.

2. Non-ferrous metals

Apart from the rolling of sheet and extrusion of sections and the drawing of wire, the production of non-ferrous metals is limited to the refining of scrap metal especially aluminium and copper. It is understood however that an aluminium smelter with an output of 40,000 tons of metal per annum based on the import of alumina (80,000 tons) will be in operation by the end of 1968.

Sudan

There is no production of iron and steel. Iron ore is available at Abutulu (36 million tons of 61 per cent Fe), Sophia (12 million tons of 60 per cent Fe.) and Fodikwan (3 million tons of 60 per cent Fe). In 1963 Sophia produced 5,000 tons and in 1965 exports were 30,000 tons.

Important reserves of copper ore exist in the Hofrat en Nahas district and are being investigated.

(b) Statistical analysis

Tables of gross output, imports and exports, etc. of basic metals on the lines required for the co-ordinated industrial study are given in Annex 1. The following table shows in greater detail the structure of these items.

In the following table the expression 'rolled' is used to indicate the same ragne of products as in the case of steel, i.e. bars, sections, sheet, etc. The main uses of copper and aluminium are in the form of bar and sheet including foil of lead in the form of bar, sheet and tubes but tin and zinc are used mainly in the crude form for coating purposes and soldering.

Table 12 : Basic metals: Annual production, trade and consumption

'000 tons

Imports

		Morocco 1963-65	Algeria 1963-64	Tunisia 1963 65	Libya 1963-65	UAR 1964/65	Sudan
Pig iron		1.2	0.3	0.4	0.5	95.0	-
Semis and ingots		1.1	4.2)	1.5	0.7	18.5	0.1
Wire rod		12.1	1.8) 37.1	(47.9	(15.3	1.2	(20.0
Bar		49.8	14.3)	(	(	73.7	(
Sections		19.9	16.8)	(11.3	(5.2	33.0	(9.0
Strip		3.0	8.6) 28.4	1.1	0.3	13.7	2.4
Plate and sheet: plain		20.0	14.2)	(12.8	9.6	96.6	(14.3
	tinned	22.3	3.2)	(		1.4	(1.3
	galvanized	5.5	2.4)	(		2.3	(
Tubes:	cast iron	2.1	(81.4	(12.2	92.8	3.0	
	steel	8.8				8.8	(8.9
Rails		3.2	(1.9	(2.0	(0.2	15.0	17.1
	accessories	1.3	(	(..	(..	2.0	
Wire		7.9	6.3	3.4	9.6	9.9	0.7
Castings and forgings		..	5.3	..	..	2.6	0.3
Total		158.1	160.7	92.6	134.2	376.7	74.1
Copper	crude	-	1.36	-	-	-	
	rolled, etc.	2.57	0.46	0.50	0.13	0.30	0.22
Nickel	crude	-	-	(0.01	-	-	
	rolled, etc.	0.31	-	(		0.02	
Aluminium							
	crude	0.09	0.17	0.01	-	-	-
	rolled, etc.	1.75	0.82	0.43	0.69	1.40	0.82
Zinc	crude	0.54	0.22	0.04	0.11	-	
	rolled, etc.	0.26	0.18	0.09	0.35	0.49	0.15
Lead	crude	0.01	0.95	0.18	-	-	
	rolled, etc	0.09	0.11	0.11	0.15	0.02	0.17
Tin	crude	0.25	0.02	0.03	-	-	
	rolled, etc.	-	0.03	0.03	0.02	0.01	0.16

Exports

Iron and Steel		0.2	3.0	-	-	7.2	-
Crude lead		15.1	) 0.77	12.7	-	-	-
Other non-ferrous		0.2	)	0.3	-	-	-

In addition to the direct consumption of basic metals recorded above, indirect consumption also takes place in the form of manufactured products and engineering goods generally. These are mainly iron and steel but non-ferrous metals, apart from the use of copper and aluminium, especially in household goods, are important in certain engineering uses, namely copper in insulated wire, lead in accumulators and zinc in dry batteries. Chemical uses are also important for zinc in the form of oxide for use in the rubber, paint and ceramic industries, for aluminium as aluminium sulphate for use in water purification, and for lead as an additive in the form of tetraethyl lead to gasoline. In the table below the following conversion factors have been used:

Copper and aluminium in insulated wire	75% and 25% of weight of product
Lead in accumulators	85% of weight of product
Zinc in dry batteries	25% " " " "
Zinc in oxide	80% " " " "
Aluminium in sulphate	16% " " " "
Lead in gasoline	64% tetraethyl lead or 0.04% gasoline or 1.2% gasoline per gallon.

Non-ferrous metals are also used as components, e.g. copper wire in electric motors and they also appear in certain unclassified items such as hand tools, locks, cutlery made of common metals but it is not practicable to estimate the quantity involved.

Net imports of manufactures

	Morocco	Algeria	Tunisia	Libya	UAR[a]	Sudan
Iron and steel goods and engineering products	59.5	105.3	50.7	88.8	180.1	64.1
Non-ferrous metal goods						
Copper:						
insulated wire and cable[b]	0.80	1.30	1.10	1.78	6.14	0.90
other	0.01	0.42	0.22	0.18	0.10	0.10
Nickel:	0.01		-		0.01	

a/ UAR figures for non-ferrous metals are estimates made by ECA. UAR figures for iron and steel are estimates made by ECA which agree in total with official figures.

b/ Distribution between aluminium and copper is estimated.

Net imports of manufactures (cont'd)

	Morocco	Algeria	Tunisia	Libya	UAR[a]	Sudan
Aluminium:						
insulated wire & cable	0.30	0.50	0.36	0.60	3.00	0.50
other	0.30	0.55	1.08	0.36	0.20	0.30
Lead	0.01	-	0.01	0.01	0.01	-
Zinc	0.05	0.03	-	0.03	0.07	
Tin	-	0.03	-		-	
Metal content chemicals:						
aluminium (sulphate)	0.23	..	..	..	2.00	..
zinc (oxide)	0.04	..	0.16	..	.05	..
(dry batteries)	0.29	..	0.23	0.25	.21	..
lead (tetraethyl)	0.10	..	..	..	.32	..
(accumulators)	0.20	..	0.21	0.22	1.87	..
lead oxide	..	..	..	..	1.10	..
aluminium oxide	..	..	..	..	.04	..
Production						
Crude steel	-	14.6	-	-	340	
Rolled steel	-	12.1	-	5.0	300	net
Iron and steel castings	5.3	4.0	1.7	-	50	
Wire	2.3	1.0	-	-	9	
Tubes	-	8.9	-	-	20	
Forging	0.6		-	-		
Crude lead	18.3	1.3	13.1	-	3.5	
Accumulator lead	1.4	0.7	-	-	-	
Lead tubes	0.6	0.5	1.0	-	-	
Aluminium rolled	0.4	0.2	-	-	(9.7	
crude	-	0.2	-	-	(	
wire						
Copper wire	2.5	1.5	-		(7.1	
other		0.8			(	
Non-ferrous castings[c]	0.7[c]	0.1	0.05	-	..	

[c] Estimated 60 per cent aluminium, 13 per cent copper, 13 per cent zinc and 13 per cent lead.

During the period under review the only production of crude steel was in Algeria from scrap and in the United Arab Republic. The bulk of ferrous scrap from the Maghreb countries was exported, the amount used in castings being relatively small. Non-ferrous scrap was also largely exported.

The following table gives the estimated consumption, both direct and indirect, of basic metal after allowing for duplication.

Net consumption of basic metal

	Morocco	Algeria	Tunisia	Libya	UAR	Sudan
Ferrous:						
Finished steel and castings	162.0	173.7	93.9	139.2	588.0	74.1
used in production of engineering goods	65.7	51.0	19.4	3.0	209.0	2.9
Imports of engineering goods	59.5	105.3	50.7	88.8	180.1	64.1
Non-ferrous						
Finished and castings	8.6	6.4	2.2	1.5	22.5	1.6
used in production of engineering goods	6.9	4.5	0.5	1.0	20.5	0.1
used in handicrafts	2.5	1.9	1.7	0.7	2.0	1.5
Imports of engineering goods (incl. above)	1.5	2.8	2.8	3.0	9.5	1.8
Chemical goods	0.7	..	0.6	0.5	4.8	..
Total: Engineering (steel and castings equivalent)	147.1	188.0	83.2	111.8	455.0	83.1
Construction	96.1	171.8	74.6	136.7	379.0	71.2
Handicrafts	1.7	1.9	1.7	0.5	2.0	1.5

C. STRUCTURE OF DEMAND AND INPUT

The distribution of the gross output is not published by any of the countries in the necessary detail or in sufficiently homogeneous classes but may be estimated partly by analogy with the position in developed countries - Annex III. The output is either intermediate to the metal using industries or is for export.

Input structure figures are only available for Morocco and are not sufficiently homogeneous and except for lead not sufficiently representative of future conditions - Annex III. The standard table given in Annex III is based on the cost data of A.3 with a total price equal to import prices and with capital charges appearing as a residual.

The incremental capital-output ratio i.e. increases in gross capital formation divided by increases in annual output (vaue added), may be obtained from the cost date in section A.3 of this paper e.g. for integrated iron and steel plant assuming a 10 per cent return on capital it is about 7 and with a 20 per cent return about 4.

D. INTRA REGIONAL TRADE

Trade in basic metals, Annex IV, has been divided into ferrous and non-ferrous products. For the 1960 matrix, prices are taken at 1964 levels.

E. COMPARISON OF PRODUCTION COSTS

1. Overall production costs i.e. including the cost of assembling raw materials at the site of manufacture, of processing on the site and of delivering the finished product to the market are affected by such items as power charges, transport charges, wages and access to raw material which vary from country to country, but also and to a more important extent by the scale of operations and by the location of the works. The effect of scale of operation has already been covered in section A. The possibilities are governed by the size of the market which can always be increased by incurring higher transport costs. As regards location there is a general choice between siting the works near the raw material or near the market, works nearer the raw material having lower costs of production but higher costs of distribution. This of course supposes that raw material supplies at the chosen location are adequate and have not to be supplemented from more distant sources.

To find the most efficient way of supplying the iron and steel requirements of the sub-region all these elements as well as a number of practical considerations have to be taken into account. This is attempted in the next section. The present section is limited to an overall estimate of the advantages and disadvantages from a cost point of view of plants located in each of the countries of the sub-region.

For this purpose the table overleaf gives estimated costs of production of cast steel in plants of 500 thousand tons per annum capacity and of sections and cold reduced sheet in plants of 200 thousand tons per annum

capacity in each of the four countries of the sub-region likely to have integrated iron and steel works.

The principal items of cost namely capital charges and overheads, fuel and specialized materials such as ferro-alloys, refractories and repair parts and materials have been taken as being effectively the same in each country, since they are very largely based on imports. Differences arise in regard to costs of other items, namely iron ore, transport on raw materials, power charges and wages. For iron ore the somewhat inferior quality of the UAR deposits and their great distance from the plant is largely offset by the current low transport rates. Morocco is superior in this respect but the reserves of ore are relatively small. UAR has an advantage in the currently low level of wages and prospective power charges, but the advantage of local coal is offset by its price and poor coking qualities. Moreover, while the sizes of plant indicated are typical of those which might be installed by 1980 on a national basis in the countries of the sub-regions other than UAR, the UAR market will be large enough to permit integrated works of 1500 thousand tons per annum capacity and a strip mill for flat products of 800 thousand tons per annum. This would reduce steel casting costs by about $4 per ton and flat rolling costs by about $9 per ton.

2. For non-ferrous metals the general position is simpler since only certain countries have the necessary ores, e.g. manganese in Morocco and the UAR, lead and zinc in Morocco and Algeria, copper in Morocco and Sudan. Of the various processes involved only concentration is strongly located. The production of crude metal from the concentrate is less strongly located and the rolling and extruding operations still less so except that countries with cheap electric power have an advantage especially in aluminium.

3. It is appropriate to compare prospective ex works prices with import prices since with the exception of the Sudan all works would be located on or near the coast i.e., near to markets and to sources of imported materials. Import prices relate to a variety of products but in the case of steel after distinguishing wire, tinplate and tubes the groupe of flat products and sections are reasonably homogeneous. In the case of the non-ferrous metals it is necessary first of all to distinguish the basic metals, i.e. aluminium, copper, etc., and then wire, foil and tubes. In practice four groups are sufficient namely crude, extruded and drawn including wire, bar, sections and tubes, rolled including sheet and foil, and castings. Average import prices for these categories are given in the table overleaf.

It will be noted that all steel making operations are profitable the return of capital ranging from 7 per cent to 13 per cent on integrated bar production. In regard to non-ferrous metal production the position as already stated is that ore prices are derived from metal prices and it is usual to take relatively constant profits at the metal making stage, while profits at the mining and concentrating stage fluctuate strongly. For import substitution products the normal margin especially on copper extrusions and sheet is low as the fabricators have to rely on copper bar from the /

Table 13 : Estimated comparative costs of production per ton of finished steel at new plants producing 500 thousand t.p.a. of cast steel and 200 thousand t.p.a. of finished steel

	UAR	Algeria	Tunisia	Morocco
i. Assembly cost				
Iron ore per ton finished steel	2.06(50%Fe)	2.06(50%)	1.87(55%)	1.61(60%)
transport to works	450km	160km	200km	25km
ex mine cost per ton	$3.0	3.0	3.0	3.0
transport cost	$1.6	3.0	1.9	0.9
total per ton finished steel	$9.5	12.4	9.2	6.3
Limestone per ton finished steel	0.5(10%silica)	0.3	....	(3-4%silica in ore)
Cost per ton finished steel	1.0	0.6	0.6	0.6
Fuel i.e. coke and oil	26.0	25.0	22.0	20.0
All other materials	13.0	13.0	13.0	13.0
Total	$49.5	$51.0	$44.8	$39.9
ii. Processing cost				
Electric power: price per unit	$0.002	$0.01	$0.025	$0.015
cost up to steel casting	$0.2	$1.2	$3.0	$1.8
section rolling	0.2	1.2	3.0	1.8
flat rolling	0.4	2.2	5.5	3.3
Wages: up to steel casting	4.0	9.6	6.4	6.4
section rolling	3.0	7.2	4.8	4.8
flat rolling	5.5	13.2	8.8	8.8
Overheads: [x] up to steel casting	4.0	4.0	4.0	4.0
section rolling	4.5	4.5	4.5	4.5
flat rolling	6.0	6.0	6.0	6.0
Capital charges:				
up to steel casting	15.0	15.0	15.0	15.0
section rolling	10.0	10.0	10.0	10.0
flat rolling	28.0	28.0	28.0	28.0
Total: up to steel casting	73.2	82.5	74.5	68.4
section rolling	17.7	22.9	22.3	28.1
flat rolling	39.9	49.4	48.3	46.1
iii. Transport costs per ton of finished steel within each national area	160 km rail	470km sea 225km rail	100km sea 160km rail	550km sea 280km rail
	$3.1	$9.1	$3.1	$9.8

[x] Taken at 4 per cent of turnover but interest on working capital equal to 2 per cent on turnover is omitted.

Table 14 : Average import prices for basic metals 1963/1964

$ per ton

	Morocco	Tunisia	Libya	UAR	Sudan	Est.Av.
Iron and steel						
Bar	105	130	105	104	107	100
Sections	127	120	108	126	124	120
Wire	170	170	100	175	160	150 *
Tubes	255	295	240	250	170	200
Plate and sheet	150		150	160	150	150
Tinplate	240	220		185	225	240
Galv. sheet	200			185		200
Castings (tube)	180	180		130		180
(other						200
Non-ferrous						
Copper: Drawn and extruded products including wire ($1200) and tubes and fittings ($1800)						
Average all countries					900	800
Rolled products					900	800
Aluminium: Drawn and extruded products including						
wire ($1400) and tubes etc. ($2000)						700
Rolled products including foil ($1200)						1000
Lead/Zinc: Rolled or extruded						500

Estimated costs of Production ex capital charges

Iron and steel:

	UAR	Algeria	Tunisia	Morocco
Integrated bar	68	83	74	66
sheet c.v.	74	94	84	76
Margin: bar	36	17	26	34
sheet c.v.	91	71	81	89
as per cent fixed capital				
bar ($250)	12.8	6.8	10.4	13.6
sheet ($430)	21.2	17.0	18.8	20.7

* h.v. 130
c.v 165

producers who are often fabricators themselves. Otherwise there is no reason why fabrication should be less profitable in North Africa than in Europe and it will be assumed that the margin is sufficient to make a domestic operation profitable. For export products such as ferro-manganese profitability depends on the cost of electric power.

F. PROJECTIONS

This section is divided into (a) projections of demand and (b) projections of production.

(a) Demand

1. The projections of demand are based on the macro-economic data given on prospective development for each country which is particularly appropriate to the basic metal industry since metals enter into every sector of the economy.

For purposes of analysis demand for basic metals has been divided into that arising from capital formation and that arising from other expenditure in the form of consumer goods, repairs and accessories. Expenditure on capital goods consisting of machinery construction and transport equipment, is of course a much more intensive user of basic metal than the other forms of expenditure and therefore in an economy expanding at an increasing rate with a steadily increasing proportion of the national product devoted to captial formation it is essential to allow for this. It has been calculated in a number of developing and developed countries that expenditure of a given amount on capital formation uses approximately five times as much basic metal as the same expenditure on non-captial goods and accordingly it is possible to take account of the basic metal content of an expanding economy by adjusting the Gross Domestic Product accordingly. This has been done in the third line of the table overleaf.

In the particular cases of Algeria and Libya it is also necessary to take account of the fact that the construction of pipe lines for petroleum is a particularly steel intensive process; the average investment being about £ 1500 per inch (width) mile equal to £ 13,000 for a ten inch pipe weighing 65 tons per mile and £ 54,000 for a 36-inch pipe weighing 380 tons per mile. This is equivalent to 4 kg to 7 kg of steel per £ investment compared with about 1.2 kg of steel per £ investment in capital formation generally. It is necessary therefore to count about 6 kg of pipe line as equal to 1 kg of steel from a capital formation point of view.

2. From the figures of adjusted GDP per head and total (adjusted) basic metal consumption per head in the various African countries a regression equation can be calculated which is

$$\text{Log metal consumption per head} = 1.217 \text{ Log adjusted GDP per head} - 1.707$$

i.e. basic metal consumption per head increases 1.217 times as rapidly as adjusted GDP per head. The regression line is shown on the attached chart.

Present and projected demand for basic metals

	Morocco				Algeria			
	1964	1970	1975	1980	1963	1970	1975	1980
1. Population (million)	12.6	15.0	17.3	20.0	11.3	13.7	15.9	18.3
2. GDP per head ($)	180	191	212	245	192	215	236	268
3. Adjusted	287	365	440	563	304	375	459	576
4. Annual rate of increase of adjusted GDP		.041	.0385	.051		.030	.041	.047
5. Corresponding rate of increase of total metal consumption		.05	.047	.062		.0365	.050	.057
6. Projected metal consumption per head (kg)								
Total	19.44	25.99	32.66	43.85	27.58	34.23	4.46	58.10
Adjusted	-	-	-	-	22.64	29.03	38.79	54.18
Engineering	11.67	15.97	20.33	27.67	16.64	18.00	24.39	34.50
Construction	7.62	9.85	12.15	16.00	4.57	9.54	13.28	18.47
Petroleum								
Tubes	-	-	-	-	6.20	6.57	4.59	4.90
Adjusted	-	-	-	-	1.25	1.31	0.92	0.98
Handicrafts	0.15	0.16	0.18	0.20	0.17	0.18	0.20	0.23
Actual metal consumption ('000 tons)								
Total	244.9	387.0	565.0	879.0	311.7	469.8	675.1	1063.2
Adjusted	-	-	-	-	255.7	398.0	616.8	991.5
Engineering	147.1	239.6	351.7	553.4	187.1	246.6	387.8	631.0
Construction	96.1	145.0	210.2	319.6	52.7	129.5	214.1	338.0
Petroleum tubes	-	-	-	-	70.0	91.2	70.0	90.0
Adjusted	-	-	-	-	14.0	18.2	14.0	18.0
Handicrafts	1.7	2.4	3.1	4.0	1.9	2.5	3.2	4.3
7. Engineering Study								
Estimated demand	119			437	151			496
Metal equivalent	147			546	188			620
Estimated production[a/]	70			264	67			323
Metal equivalent	73			288	56			362
Includes non-ferrous wire or wire rod	3			5	2			5

a/ Includes assembly.

Present and projected demand for basic metals (cont'd)

	Est. distr. of types	Morocco 1964	Morocco 1970	Morocco 1975	Morocco 1980	Algeria 1963	Algeria 1970	Algeria 1975	Algeria 1980
8. Engineering requirements									
Total		72.6			288	55.5			362
Non-ferrous		6.9			51	4.5			64
Ferrous		65.7		160	237	51.0		179	298
Iron castings	15%	5.3		24	35	7.6		27	45
Flats	48%	36.1		77	114	24.5		86	143
Sections	30%	19.7		48	71	15.3		53	89
Steel tubes	5%	3.3		8	12	2.6		9	15
Steel castings and forgings	2%	1.3		3	5	1.0		4	6
9. Construction requirements									
Total		96.1		210	320	122.7		214	338
Iron castings and tubes	5%	2.1		10	16	1.7		7	12
Flats	15%	19.3		31	48	3.9		22	37
Sections	75%	69.2		158	240	38.3		108	187
Steel tubes	5%	5.5		11	16 b/	8.8		7	12
Petroleum tubes		-		-	-	70.0		70	90
10. Handicraft Non-ferrous		1.7	2.4	3.1	4	1.9			4
11. Total - iron and steel		161.8		370	557	173.8		393	636
Iron castings		7.4		34	51	9.3		34	57
Plate				54	81			49	81
Sheet		55.4		43	64	28.4		46	78
Tin plate				12	17			13	21
Bar				114	170			81	129
Wire rod				21	32			24	40
Light sections		88.9		23	35	53.6		19	32
Medium sections				30	49			26	45
Rails				8	12			5	9
Heavy sections				9	14			6	11
Seamless tubes				6	9			5	9

b/ Including petroleum tubes if any.

Present projected demand for basic metals (cont'd)

	Morocco				Algeria			
	1964	1970	1975	1980	1963	1970	1975	1980
Est. distr. of types								
Welded tubes	8.8		13	19	11.4		11	18
Petroleum tubes	-				70.0		70	90
Alloy steels (included above 5%)				(28)			(32)	
Forgings	1.3		3	5	1.0		4	6
12. Total - non-ferrous	8.6		32	55	6.4		34	68
Aluminium %		38.3	42.7	47.0				
Total	2.0		13.6	26.0	2.0		16.0	32.0
Rolled 49%			6.6	12.8			7.9	15.8
Extruded 24%	(0.5)		3.3	6.2			3.8	7.6
Castings 24%	(0.5)		3.3	6.2	(0.1)		3.8	7.6
Other 3%			0.4	0.8			0.5	1.0
Copper %		29.1	28.1	26.8				
Total	2.8		9.0	14.7	2.8		9.1	18.2
Rolled 18%			1.6	2.6			1.7	3.3
Extruded 69%			6.2	10.1			6.3	12.6
Castings 10%	(0.2)		0.9	1.5			0.9	1.8
Other 3%			0.3	0.4			0.2	0.5
Zinc %		18.3	16.8	15.4				
Total	0.8		5.4	8.5	0.4		5.2	10.5
Galvanizing 30%			1.6	2.5			1.6	3.1
Castings 20%	-		1.1	1.7			1.0	2.1
Extruded 25%			1.3	2.1			1.3	2.6
Rolled 12½%			0.7	1.1			0.7	1.3
Other 12½%			0.7	1.1			0.6	1.3
Lead %		13.6	11.8	10.7				
Total	2.0		3.8	5.6	1.1		3.5	7.0
Rolled & extr. 50%			1.9	2.8			1.8	3.5
Castings 15%			0.4	0.8			0.5	1.0
Other 35%			1.15	2.0			1.2	2.5
Tin %		0.7	0.6	0.5				
Total	0.3		0.2	0.2	(0.05)		0.2	0.3
Tin plate 50%			0.1	0.1			0.1	0.15
Other 50%			0.1	0.1			0.1	0.15

Present and projected demand for basic metals

	Tunisia				Libya			
	1964	1970	1975	1980	1964	1970	1975	1980
1. Population (million)	4.3	5.1	5.9	6.8	1.6	1.9	2.2	2.5
2. GDP per head ($)	190	224	263	316	590	1135	1365	1680
3. Adjusted	375	490	619	772	1570	3970	3000	3700
4. Annual rate of increase of adjusted GDP		.046	.048	.045		.168	-.058	.042
5. Corresponding rate of increase of total metal consumption		.056	.058	.055		.204	-.071	.051
6. Projected metal consumption per head (kg)								
Total	37.09	51.38	68.05	88.93	157.3	348.6	256.7	336.6
Adjusted	-	-	-	-	104.8	319.1	220.8	292.3
Engineering	19.35	32.48	43.38	57.02	69.4	208.6	144.1	191.0
Construction	17.34	18.43	24.12	31.24	30.9	103.3	68.0	90.5
Petroleum tubes	-	-	-	-	56.4	35.8	43.6	53.8
Adjusted	-	-	-	-	11.2	7.2	8.7	10.8
Handicrafts	0.40	0.47	0.55	0.67	0.4	0.8	1.00	1.25
Actual metal consumption ('000 tons)								
Total	159.5	262.0	401.5	604.7	251.7	662.3	564.7	841.5
Adjusted	-	-	-	-	167.7	606.3	485.8	730.8
Engineering	83.2	165.6	255.9	187.7	111.8	396.3	317.0	477.5
Construction	74.6	94.0	142.3	212.4	46.2	70.1	149.6	226.2
Petroleum tubes	-	-	-	-	90.0	194.3	96.0	134.4
Adjusted	-	-	-	-	18.0	139.9	19.2	26.9
Handicrafts	1.7	2.4	3.2	4.6	0.5	1.5	2.2	3.0
7. Engineering study								
Estimated demand	66			224	90			460
Metal equivalent	83			280	112			575
Estimated production[a/]	17			96	10			138
Metal equivalent	20			105	4			149
Includes non-ferrous wire or wire rod				-	-			7

a/ Includes assembly.

(cont'd)

	Est. distr. of types	Tunisia 1964	1970	1975	1980	Libya 1964	1970	1975	1980
8. Engineering requirements									
Total		19.9			105	4.0			149
Non-ferrous		0.5			18	1.0			26
Ferrous		19.4		54	87	3.0		41	123
Iron castings	15%	2.9		8	13	0.4		6	18
Flats	48%	9.3		26	42	1.5		20	60
Sections	30%	5.8		16	26	0.9		12	37
Steel tubes	5%	1.0		3	4	0.2		2	6
Steel castings and forgings	2%	0.4		1	2	-		1	2
9. Construction requirements									
Total		74.6		142	212	136.2		150	226
Iron castings and tubes	5%	-		7	11	0.5		3	5
Flats	15%	4.6		21	32	8.4		8	14
Sections	75%	58.8		107	159 b/	34.7		40	68
Steel tubes	5%	11.2		7	10 b/	2.6		3	5
Petroleum tubes		-		-	-	90.0		96	134
10. Handicraft Non-ferrous		1.7			5	0.7			3
11. Total - iron and steel		94.0		196	299	139.2		191	349
Iron castings		1.7		15	24	0.9		9	23
Plate				27	42			14	32
Sheet		13.9		16	26	9.9		11	33
Tin plate				4	6			3	9
Bar				73	109			28	53
Wire rod				7	12			5	16
Light sections		64.6		13	19	356		6	12
Medium sections				19	28			8	17
Rails				5	8			2	3
Heavy sections				6	9			3	4
Seamless tubes				3	5			2	4

b/ Including petroleum tubes if any.

	Est. distr. of types	Tunisia 1964	Tunisia 1970	Tunisia 1975	Tunisia 1980	Libya 1964	Libya 1970	Libya 1975	Libya 1980
Welded tubes		12.2		7	9	4.0		3	7
Petroleum		-		-	-	88.8		996	134
Alloy steels (included above)	5%				(15)				(17)
Forgings		-		1	2	-		1	2
12. Total - non-ferrous		2.4		11	23	1.5		14	29
Aluminium	%								
Total		0.4		5.2	10.8	0.7		6.7	13.5
Rolled	49%			2.6	5.4			3.3	6.7
Extruded	24%			1.3	2.6			1.6	3.2
Castings	24%			1.2	2.6			1.6	3.2
Other	3%			0.1	0.3			0.2	0.4
Copper	%								
Total		0.5		3.0	6.2	0.1		3.8	7.8
Rolled	18%			0.5	1.1			0.7	1.4
Extruded	69%			2.1	4.3			2.6	5.4
Castings	10%			0.3	0.6			0.4	0.8
Other	3%			0.1	0.2			0.1	0.2
Zinc	%								
Total		0.1		1.7	3.5	0.5		2.3	4.7
Galvanizing	30%			0.5	1.1			0.7	1.4
Castings	20%			0.4	0.7			0.4	0.9
Extruded	25%			0.4	0.9			0.6	1.2
Rolled	12½%			0.2	0.4			0.3	0.6
Other	12½%			0.2	0.4			0.3	0.6
Lead	%								
Total		1.3		1.1	2.4	0.2		1.4	2.9
Rolled & extr.	50%			0.6	1.2			0.7	1.5
Castings	15%			0.2	0.4			0.2	0.4
Other	35%			0.3	0.8			0.5	1.0
Tin	%								
Total		0.1		0.05	0.1			0.05	0.1
Tin plate	50%				0.05				0.05
Other	50%				0.05				0.05

Present and projected demand for basic metals

	United Arab Republic				Sudan			
	1964	1970	1975	1980	1964	1970	1975	1980
1. Population (million)	28.4	33.3	38.0	43.3	12.5	15.4	17.9	20.7
2. GDP per head ($)	141	166	194	239	94	100	110	128
3. Adjusted	271	337	420	563	154	175	213	276
4. Annual rate of increase of adjusted GDP		.037	.045	.060		.021	.040	.055
5. Corresponding rate of increase of total metal consumption		.045	.055	.073		.26	.047	.57
6. Projected metal consumption per head (kg)								
Total	29.42	38.29	50.06	71.20	12.46	14.51	18.23	24.04
Adjusted	–	–	–	–	–	–	–	–
Engineering	16.03	24.19	31.76	45.70	7.14	8.66	10.91	14.70
Construction	13.32	14.02	18.21	25.38	5.20	5.72	7.17	9.16
Petroleum tubes	–	–	–	–	–	–	–	–
Adjusted	–	–	–	–	–	–	–	–
Handicrafts	0.07	0.08	0.09	0.42	0.12	0.13	0.15	0.18
Actual metal consumption ('000 tons)								
Total	835.6	1275.1	1902.3	3083.0	155.8	223.5	326.3	497.6
Adjusted	–	–	–	–	–	–	–	–
Engineering	455.0	805.5	1206.9	1978.8	83.1	133.4	195.3	304.3
Construction	378.6	466.9	692.0	1099.0	71.2	88.1	128.3	189.6
Petroleum tubes	–	–	–	–	–	–	–	–
Adjusted	–	–	–	–	–	–	–	–
Handicrafts	2.0	2.7	3.4	5.2	1.5	2.0	2.7	3.7
7. Engineering study								
Estimated demand	364			1200	66			217
Metal equivalent	455			1500	83			271
Estimated production[a]	205			760	4			59
Metal equivalent	230			900	3			67
Includes non-ferrous wire or wire rod	7			25	–			–

a/ Includes assembly.

	Est. distr. of types	United Arab Republic 1964	1970	1975	1980	Sudan 1964	1970	1975	1980
8. Engineering requirements									
Total		230.0			900	3.0			67
Non-ferrous		21.0			160	0.1			12
Ferrous		209.0		495	740	2.9		22	55
Iron castings	15%	31.3		74	111	0.4		3	8
Flats	48%	100.3		238	355	1.4		11	26
Sections	30%	62.7		148	222	0.9		7	17
Steel tubes	5%	10.5		25	37	0.2		1	3
Steel castings and forgings	2%	4.2		10	15	-		-	1
9. Construction requirements									
Total		378.6		692	1100	71.2		128	190
Iron castings and tubes	5%	21.3		34	55	-		6	9
Flats	15%	40.0		104	165	14.2		19	29
Sections	75%	296.0		519	825	48.3		97	143
Steel tubes	5%	21.3		35	55 b/	8.7		6	9
Petroleum tubes		-		-	-	-		-	-
10. Handicraft Non-ferrous		2.0			5	1.5			4
11. Total - iron and steel		587.6		1187	1840	74.2		150	245
Iron castings		52.6		108	166	0.4		9	17
Plate				171	264			22	34
Sheet		140.3		135	203	15.6		6	17
Tin plate				36	53			2	4
Bar				368	578			63	96
Wire rod				68	100			3	8
Light sections		358.7		74	115	49.2		11	17
Medium sections				102	166			16	25
Rails				26	41			5	7
Heavy Sections				29	45			6	7
Seamless tubes				20	31			2	4

b/ Including petroleum tubes if any.

	Est. distr. of types	United Arab Republic 1964	1970	1975	1980	Sudan 1964	1970	1975	1980
Welded tubes		31.8		40	63	8.9		5	8
Petroleum tubes		-			-	-		-	-
Alloy steels (included above	5%			(60)	(92)			(7)	(12)
Forgings		4.2		10	15	-		-	1
12. Total - non-ferrous		23.0		100	165	1.6		8	16
Aluminium	%								
Total		11.1		46.5	77.5	0.8		3.8	7.5
Rolled	49%			22.8	38.0			1.9	3.7
Extruded	24%			11.2	18.6			0.9	1.8
Castings	24%	0.5		11.2	18.6			0.9	1.8
Other	3%			1.3	2.3			0.1	0.2
Copper	%								
Total		7.4		26.5	44.2	0.3		2.1	4.3
Rolled	18%			4.8	8.0			0.4	0.8
Extruded	69%			18.3	30.5			1.5	3.0
Castings	10%			2.6	4.4			0.2	0.4
Other	3%			0.8	1.3			0.05	0.1
Zinc	%								
Total		0.5		15.2	25.4	0.2		1.2	2.5
Galvanizing	30%			4.5	7.6			0.4	0.8
Castings	20%			3.1	5.1			0.3	0.5
Extruded	25%			3.8	6.3			0.3	0.6
Rolled	12½%			1.9	3.2			0.1	0.3
Other	12½%			1.9	3.2			0.1	0.3
Lead	%								
Total		3.5		10.2	17.0	0.2		0.8	1.6
Rolled % extr.	50%			5.1	8.5			0.4	0.8
Castings	15%			1.5	2.5			0.1	0.2
Other	35%			3.6	6.0			0.3	0.6
Tin	%								
Total				0.5	0.9	0.1		0.05	0.1
Tin plate	50%			0.3	0.5				0.05
Other	50%			0.2	0.4				0.05

From this equation projected consumption per head can be calculated as in the sixth line of the table overleaf.

This projected consumption is then divided into engineering[1/] goods and construction goods. The basis for this is once more a regression equation namely:

Consumption of engineering goods per head = 0.657 total consumption of basic metal per head - 0.97 kg

suggesting which is perhaps reasonable that there is no consumption of engineering goods until the economy has reached a certain minimum level of total consumption.

3. The demand for construction must be met from domestic sources but the demand for engineering goods may also be met by imports. This has been the subject of a separate study for the engineering industries and the result is given in the seventh entry of the table. It will be noted that in the case of Tunisia and UAR the engineering estimates of demand are lower than those given by the present method, which suggests that construction was unduly high in these countries during the basic period.

4. In the eighth entry the basic metal content of domestic output of engineering goods is given in terms of non-ferrous and ferrous metals and the latter divided into the principal types.

The division between non-ferrous and ferrous has been made once more on the basis of a regression equation namely:

Consumption of non-ferrous metal per head - 0.165 production of engineering goods per head - 0.1 kg.

Since the regression equations are based however on conditions at the present time reflecting therefore only the changes in demand resulting from changes in income per head, it is necessary to make some adjustment for changes over time. These changes consist of a very slow substitution of steel by other materials including aluminium. Using the estimates made by the steel committee of the Economic Commission for Europe it will be assumed that steel will lose about 2.4 per cent of its potential output to other materials of which 1.0 per cent will be aluminium. This is in addition to the income effect and is included in entry eight.

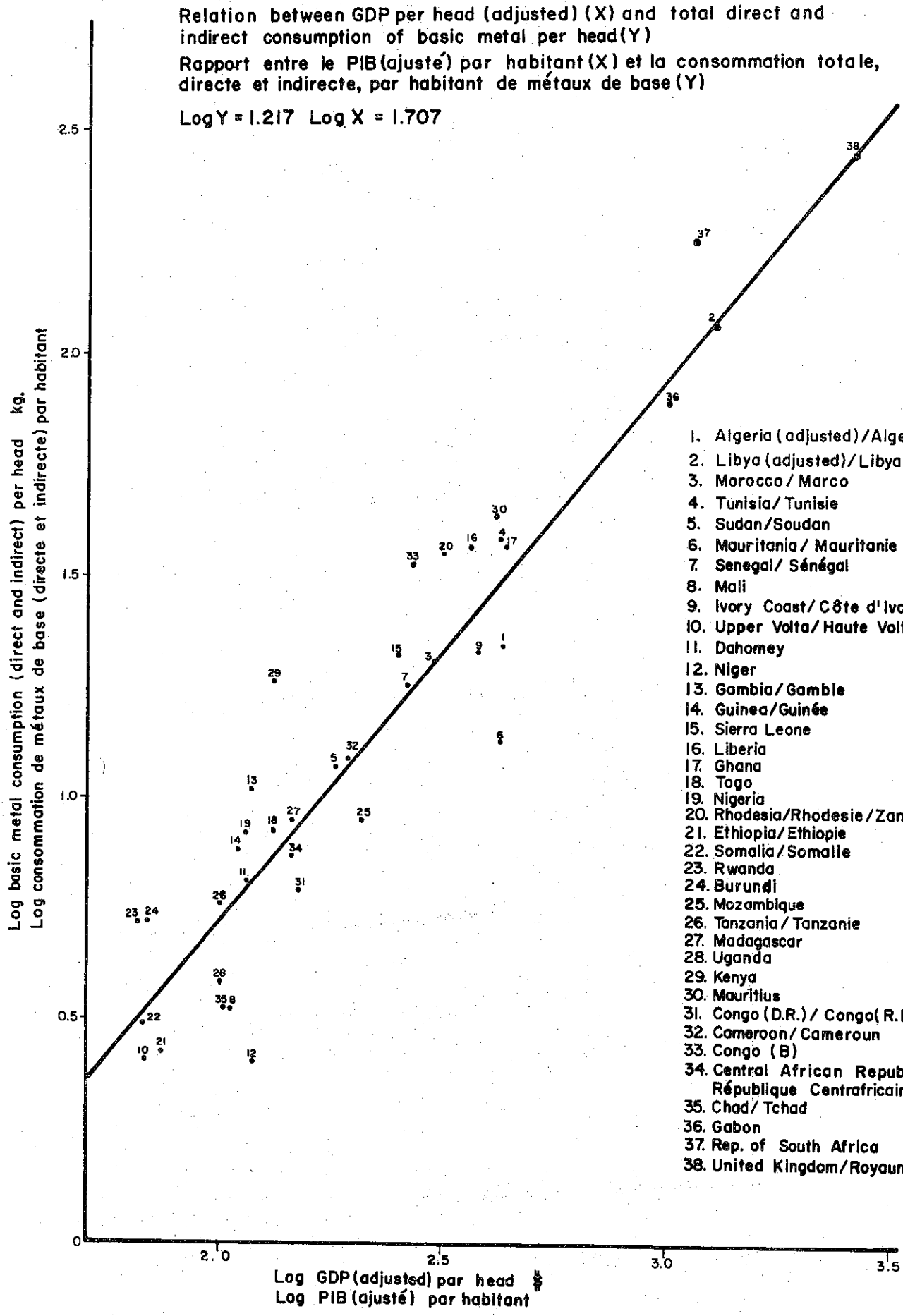
The division of ferrous consumption into castings, flats, etc., has been made on the basis of that obtaining in the engineering industries of developed countries. The corresponding division of construction material into types, line 9 has been obtained in the basic year by subtraction from total actual consumption. It is in fact also very close to the distribution obtaining in developed countries - difference arises later e.g. construction in developing countries where wages are low is primarily based on ferro-concrete and in developed countries on sections.

1/ More exactly factory goods and including all non-ferrous metal products and neglecting the small proportion used directly in construction.

Relation between GDP per head (adjusted) (X) and total direct and indirect consumption of basic metal per head (Y)

Rapport entre le PIB (ajusté) par habitant (X) et la consommation totale, directe et indirecte, par habitant de métaux de base (Y)

Log Y = 1.217 Log X = 1.707



1. Algeria (adjusted)/Algerie(ajusté)
2. Libya (adjusted)/Libya (ajusté)
3. Morocco/Marco
4. Tunisia/Tunisie
5. Sudan/Soudan
6. Mauritania/Mauritanie
7. Senegal/Sénégal
8. Mali
9. Ivory Coast/Côte d'Ivoire
10. Upper Volta/Haute Volta
11. Dahomey
12. Niger
13. Gambia/Gambie
14. Guinea/Guinée
15. Sierra Leone
16. Liberia
17. Ghana
18. Togo
19. Nigeria
20. Rhodesia/Rhodesie/Zambia/Malawi
21. Ethiopia/Ethiopie
22. Somalia/Somalie
23. Rwanda
24. Burundi
25. Mozambique
26. Tanzania/Tanzanie
27. Madagascar
28. Uganda
29. Kenya
30. Mauritius
31. Congo (D.R.)/Congo(R.D.)
32. Cameroon/Cameroun
33. Congo (B)
34. Central African Republic
    République Centrafricaine
35. Chad/Tchad
36. Gabon
37. Rep. of South Africa
38. United Kingdom/Royaume-Uni

5. A special case, however, is the demand for tubes by the petroleum industry in Algeria and Libya which for all practical purposes consists of pipelines for transporting and gathering crude petroleum and distributing the refined products and therefore depends on the location of the oil deposits in relation to the markets, whether ports for shipment overseas or domestic refineries and consumers, and also on the capacity of the pipeline installed. On the assumption, however, that the location of oil producing centres does not change appreciably and that substantially the same size (diameter) of pipeline is used, then there should be a fairly exact relation between the annual production of petroleum and the total stock of pipeline in the country. The relevant figures are given in the following table and it may be seen that this relation is in fact a loose one, 8 tons of tubing being required for an increase of one thousand tons per annum in petroleum production in Libya while in Algeria where the centres of production are more distant from the sea the figure is 27 tons.

Petroleum production and steel pipe consumption

	Petroleum production (million tons)		Consumption of iron and steel pipe and accessories less 10% of total consn. of iron and steel ('000 tons)		Estimated stock for petroleum purposes, end year	
	Algeria	Libya	Algeria	Libya	Algeria	Libya
1957	-	-	25	-	25	-
1958	0.4	-	84	-	109	-
1959	1.2	-	110	-	219	-
1960	8.6	-	146	30	365	30
1961	15.7	0.7	111	32	476	62
1962	20.5	7.9	60	96	536	158
1963	23.6	22.4	70	84	606	242
1964	26.3	41.5	95	105	701	347
1965	26.5	58.5		77		424

The petroleum study does not confirm these projections after 1970-75. For Algeria, it is expected that production may increase by up to 3,000 t.p.a. up to 1970 after which it will be stationary so that pipeline demand would be approximately as given above until 1970 but afterwards would virtually cease. For Libya, production is estimated to increase by 20,000 t.p.a. up to 1970 and by 6,000 up to 1975, i.e. over the whole period more or less as indicated above but would cease to increase after 1975. UAR production is estimated to increase by 2,000 t.p.a., requires perhaps 10/20,000 tons of pipe line.

For Algeria it is assumed in accordance with the general framework of the projections that output will increase by 8 per cent per annum from 1964 to 1970 and thereafter by 5 per cent per annum while the corresponding

figures for Libya are 20 per cent and 7 per cent. Under these circumstances annual production of petroleum in Algeria will be increasing by 2.6 thousand tons per annum in 1975 for example thus requiring 70 thousand tons of tube per annum while the corresponding figures for Libya will be 12.0 and 96 respectively.

6. The domestic demand for non-ferrous metals is first of all divided into that for the principal metals on the basis of the present world distribution and prospects A.2. and then into the three types namely rolled products, drawn and extruded products and castings on the basis of the present distribution in the United Kingdom. Chemical uses are included in "other".

The export demand for crude non-ferrous metals is of course important and is dealt with in the following section as part of the production forecast.

(b) Production

(i) Before projecting the production of basic metals it is necessary to make two adjustments to the preceding demand projections. First of all the broad groupings of flat products and sections in the case of steel must be broken down into types; in the case of sections into bar, wire rod, light sections, medium sections and heavy sections and in the case of flat products into plate, sheet and tinplate since in general specialized plants will undertake the production of these products. Tubes are divided into seamless, welded and petroleum tubes, the last item consisting largely of welded tube for pipeline.

The estimated proportions are as follows:

Table 15 : Distribution of types of steel

		Construction	Engineering
Flats:	Plate	85	35
	Sheet	15	50
	Tinplate	-	15
Sections:	Bar	65	20
	Wire rod	-	45
	Light	10	15
	Medium	15	18
	Rails	5	-
	Heavy	5	2
Tubes:	Seamless	1/3	
	Welded	2/3	

and the projections are given in item II

In the case of the non-ferrous metals however the existing division is adequate since a higher degree of specialization than that between type of metal and between rolled and extruded products is not necessary.

Secondly, allowance must be made for the fact that not all varieties ie qualities and sizes can be economically manufactured even on a sub-regional basis, in particular the market for heavy sections is not large enough while for tubes and wire it will be assumed that only two-thirds of seamless tubes, wire and petroleum tubes can be manufactured. Otherwise imports of 10 per cent will be assumed.

(ii) Proposed plants: Iron and steel

Before listing the proposed plants it is desirable to summarize the general position.

From Table 5 it may be seen that the reduction in costs of production made possible by an increase in the scale of operation from 200 thousand to 500 thousand tons a year is of the order of $13 per ton for cast steel plus a further $4 for rolled bar or $8 for cold reduced sheet. At the same time from Table 8 it may be seen that the extra cost of transporting one ton of finished steel by small cargo steamer along the coast of North Africa is of the order of $0.8 per thousand km. It is therefore clear that in theory it would be better to manufacture all the iron and steel requirements of the North African sub-region in one plant. There are two reasons why this cannot be advocated. First the very practical one that UAR, Algeria and Tunisia already have iron and steel plants and secondly the situation in regard to iron ore reserves, where apart from the present inaccessible reserves at Gara Djebilet in Algeria and in the Shatti valley in Libya, reserves in each country are only sufficient for its own requirements. In detail reserves in Morocco are estimated now at only about 25 million tons after 1970 i.e. sufficient to last 25 years at an extraction rate of 1 million per annum. If the present plan to establish an integrated works with a capacity of 180 thousand tons per annum of finished steel is proceeded with the exports of ore would have to be halved while the other half would sustain the works for 25 years - a minimum life. Reserves in Algeria apart from Gara Djebilet are estimated at about 150 million tons. One million tons per annum will be required for the steel plant at its proposed capacity which is adequate for the expected demand up to 1975. Subsequently with demand doubling every ten years or so the capacity of the plant might also be doubled in which case leaving exports of ore at their present level of about 3 million tons per annum reserves would last some forty years. Reserves in Tunisia consist of some 50 million tons in the accessible Djerissa/Tamara deposits and a possible further 30 in the more distant Djebel Ank deposit. The existing steel works working to capacity as it will in due course could produce 150 thousand tons of iron per annum equal to 250 thousand tons of ore.

From about 1980 onwards capacity could be doubled in which case leaving exports of ore at their present level of about one million tons per annum reserves would last 40 to 50 years. In the UAR reserves are of the order of 300 million tons while 1980 requirements will be about 4 million tons per annum doubling every ten years so that reserves are again at about the forty year level.

3. It is of course always possible to import ore from other countries but in this case one of the main advantages which a developing country has in establishing an iron and steel industry is lost. An important issue is therefore the future development of the extensive Gara Djebilet deposits. These are estimated at 765 million tons of 58 per cent Fe with a possible further 230 million. It also appears possible to beneficiate the ore to a still higher Fe content which is important in view of the distance over which it will be necessary to transport it. The alternatives are either to construct a railway to the Atlantic coast in Morocco, say, at Agadir a distance of 500 km or to construct one to join the existing Algerian system at Abadla a distance of 700 km.

If the first alternative were followed it would be possible to establish a large integrated iron and steel works at Agadir which could supply a large part of North African requirements while at the same time ore could be shipped to other producing centres in the sub-region. If the second alternative were followed an integrated iron and steel works could be established at Abadla based on local coal which could supply a large part of Algerian requirements while at the same time ore could be railed to other producing centres on the mediterranean coast.

Insufficient information is available at the moment on the Abadla coal deposits to make precise calculations as to the relative advantages of these alternatives. It is understood that the deposits are extensive - of the order of 500 million tons - and that the coal has coking qualities although these may not be sufficient for metallurgical purposes unless mixed with a small quantity of high quality imported coal. It is also understood that the ash content is high and the same only about 1m thick. Under these circumstances it is doubtful if a satisfactory coke could be produced at a lower price than about $10 per ton which would save however about $10 on the cost of manufacture of finished steel. The alternative transport costs, using Morocco rates, in relation to one ton of finished steel are as follows:

	Plant at Agadir	
Ore by rail to Agadir $4.8	Finished steel to Casablanca 500 km by sea $5.4.	Total 10.2
	Finished steel to Algeria 1800 km by sea $6.4	Total 11.2
	Plant at Abadla	
Ore by rail to Abadla $7.2	Finished steel to Casablanca 500 km by rail plus 1000 km by sea $13.0	Total 20.2
	Finished steel to Algiers 1000 km by rail $13.2	Total 20.4

If a plant located at Abadla could save $10 on coke then the two locations would be approximately similar in total costs. It will be assumed however that a decision on this important issue could not be implemented before 1980 and will therefore not be taken into account in the present projections.

4. It is understood that the Maghreb countries have recommended that the new steel plants to be constructed should specialize e.g. either on flats or on sections. This is obviously desirable where transport costs are relatively low and may be illustrated in the case of Morocco and Algeria. Assuming which is approximately true that the demand in Morocco is for 300 thousand tons of sections and 200 thousand flats while in Algeria it is 250 thousand sections and 250 flats then if all requirements were produced in one location costs at the million ton per annum plant would be from table about $68.4 per ton for cast steel plus 21.7 for sections or 34.2 for flats. If all requirements were produced separately in each location then the corresponding costs would rise to $74.3, 24.8 and 41.5 respectively. If the two locations specialized then costs for steel making would remain at $74.3 per ton but would fall on steel rolling to the previous levels of $21.7 for sections and $34.2 for flats. The extra transport charges incurred in exchanging sections and flats would be about $5.8 so that the net saving would be about $4.6 per ton. On the other hand transport charges to centres of consumption in the Sudan at about $15 per ton from UAR are high enough to justify integrated production there although this will not be proposed before 1980 because of the need to develop the Abu Tulu deposits. At the same time regard should be had to the possibility of establishing re-rolling works at little additional cost since economies of scale are only lost at the rolling stage.

5. Proposals for new plants may be presented in the light of existing plans dealing first with the situation in the UAR. Here the main elements now in course of construction are understood to be:

(i) A wide strip mill with tinning and galvanizing facilities with an ultimate capacity of 750,000 tons per annum and immediate production of 500,000;

(ii) Medium section mill with an output of 100,000 tons per annum;

(iii) Increase in light section production of about 100,000 tons per annum.

This would mean increasing the output of ingot steel at the existing integrated plant at Helwan from about 250,000 to about 1.5 million tons per annum.

In addition it is proposed to establish in due course a second integrated plant at Aswan with a capacity of about 400,000 tons per annum of round bars to be produced in a continuous mill. A later proposed development is the establishment of a wide plate mill with a capacity of about 200,000 tons per annum.

The three existing semi-integrated, i.e. scrap melting works are also expected to double their capacity from the present level of about 180,000 tons to 360,000 per annum, one of them specializing in alloy steels.

These plans will now be examined having regard to the demand projections of the preceding section. First in respect of flat products it will be assumed that the UAR also produces the requirements for the Sudan and secondly the requirements for the whole sub-region in respect of plate. This plate however will consist only of the wider varieties accounting for perhaps one-third of the total demand for plate as given in the estimates the remaining two-thirds being produced on the wide strip mills. On this basis the UAR demand for plate in 1980 will be 178,000 tons and would justify the erection of a mill of 200,000 tons capacity by then. The demand for wide strip in 1980 will be 525,000 tons including strip for welded tubes and would justify the erection of a mill of capacity 500,000. Demand in 1975 will be about 350,000 so that the mill will work to little more than half capacity for some years but this is a consequence of having one strip mill in the UAR and the other in Algeria. Tin plate capacity of about 50,000 tons per annum may also be installed.

With regard to sections etc. the demand for medium sections including rails in the UAR and Sudan will be about 240,000 tons in 1980 and 150,000 in 1975 justifying a mill of capacity 200,000 in the current expansion programme. For wire rod it seems desirable to establish a continuous mill in the UAR to meet all the requirements of the sub-region amounting to about 210,000 tons in 1980 as well as additional bar capacity for UAR requirements amounting to about 350,000 tons, i.e. a rod and bar mill of capacity 500,000 tons by 1975. An additional demand for about 50,000 tons light sections and some types of bar can be met probably from existing capacity. For the Sudan it is proposed to manufacture bar and light sections in a re-rolling mill of 100,000 tons per annum capacity based on billets from the UAR but with scrap melting facilities of about 50,000 tons.

With regard to tubes capacity for welded tubes will be required to the extent of about 70,000 tons per annum.

6. Turning now to the Maghreb countries and dealing first with Algeria there will be a Maghreb market for wide strip products of about 467,000 tons in 1980 and 278,000 in 1975 excluding strip for petroleum pipe lines. If by agreement with the petroleum countries about two-thirds of the demand for petroleum pipe can be met by welded pipe, probably spirally welded, made locally then the total demand will rise to about 617,000 tons in 1980 and 389,000 in 1975. These figures are compatible with the current construction of a wide strip mill of 400,000 tons per annum capacity provided, as is no doubt the case, that plans allow for future extensions, and 600,000 is taken as the required capacity in this report. Re-rolling can be decentralized, e.g. tinplate in Morocco.

For sections etc. it seems appropriate to manufacture bar and light sections in Morocco and Tunis on an integrated basis and in Libya and Algeria on a re-rolling plus scrap melting basis. This means capacity of about 200,000 tons per annum by 1980 in Morocco and of 60,000 in Libya. The present capacity of about 100,000 tons per annum in Tunis will have to be expanded to about 150,000 and in Algeria from about 40,000 to 170,000. Scrap melting units will provide all Libya's requirements of steel but for Algeria it will probably be necessary to rely partly on billets from the integrated strip works or from a works based on the Gara Djebilet deposits. The Maghreb requirements for medium sections amounting to 140,000 tons in 1980 should be met by a single integrated works and having regard to existing supplies of iron ore it seems best to locate this in Tunis.

Welded tube plants can be established in all the countries concerned, with spirally welded petroleum tube capacity in Algeria and Libya. Seamless tubes could be manufactured on a sub-regional basis in the UAR, perhaps 60,000 tons per annum capacity.

7. Proposed Plants: non-ferrous metals

Dealing first with import substitution projects the total demand for aluminium products in 1980 will be of the order of 170,000 tons and in 1975 of 90,000 tons. It seems appropriate to manufacture the metal in the UAR from imported alumina taking advantage of the anticipated low cost of electric power. The plant, now in course of construction with a capacity of 40,000 tons is only large enough to meet present demand for the sub-region, or 1975 demand in the UAR, and could be expanded. Slabs and bars may be sent from this plant if desired to rolling and extrusion and drawing plants elsewhere, and it would seem appropriate to establish one such plant in Algeria for the Maghreb countries. Capacity both in Algeria and the UAR could be of the order of 40,000 tons per annum for rolling and 20,000 for drawing and extrusion.

The total demand for copper products will be only about half that for aluminium and justifies only one works for the sub-region. An extension to the existing plant in the UAR raising capacity to 20,000 tons per annum rolled products and 60,000 extruded and drawn products is proposed based on imported copper. After 1980 if the Sudan copper deposits are developed the production of copper may be undertaken.

The demand for rolled and extruded lead products will amount by 1980 to about 18,000 tons and would justify a single plant for the whole sub-region of capacity 20,000 tons located in Morocco.

For zinc the demand for rolled products will amount to about 8,000 tons and for extruded products to about 14,000 tons justifying capacity of about 20,000 tons per annum and located in Algeria.

8. Export projects relate to the export of lead, zinc and ferro-manganese, location depending on existing and prospective supplies of ore.

Manganese ore in sufficient supply to justify the production of ferro-manganese exists in Morocco and in the UAR. Production from the Morocco ore is expected to slowly decline from the present level of about 350,000 tons per annum to about 250,000 in 1980 while in the case of the UAR there will be an increase from about 185,000 to 300,000 tons per annum. Assuming 40 per cent metal content of the ore and 80 per cent ferro-manganese, plants of 50,000 tons per annum capacity would require 100,000 tons of ore and might be a useful beginning. Location would be near the ore.

The position in regard to lead and zinc is more complicated since Morocco, Algeria and Tunisia all have deposits. In the Ouida area of Morocco output of lead concentrate will be fairly constant at about 35,000 tons per annum which is sufficient for the existing foundry at Oued el Heimer. The remaining output is in the Moloujou-Mibladen area at about 40,000 tons rising to 60,000 in 1980 and capable therefore of sustaining another foundry in that area. Output of lead in Tunisia will probably not exceed 30,000 tons per annum which is barely sufficient for the existing foundry at Tunis, but additional supplies could probably be obtained from numerous small deposits in Algeria and Morocco.

Zinc deposits are found in the Ouida areas of Morocco where output is expected to rise from about 40,000 tons of concentrate at present to about 70,000 in 1980 and in the adjacent area of Algeria where output is expected to rise slightly from the present level of 50,000 to about 60,000 tons per annum. Output of zinc concentrate in Eastern Algeria - Kherret Youssef area - is expected to rise sharply to 60,000 tons per annum in 1980 and in Tunisia to 40,000 tons per annum.

It would therefore be possible to establish one zinc foundry of capacity about 100,000 tons of concentrate in the Ouida area of Morocco either on the Moroccan or Algerian side and a similar one in the East Algeria-Tunisia region. The exact location obviously depends on negotiations between the countries concerned. The solution given in this report is to establish the Ouida foundry in Morocco with imports of concentrate from Algeria and the second foundry in East Algeria with imports of concentrate from Tunisia. At the same time lead concentrate could be exported to Tunisia to enable an increase in the capacity of the lead foundry there.

9. All countries can economically produce their own castings from scrap metal, a high degree of purity not being required. The various increases in capacity for the production of basic metals are repeated in the table overleaf.

G. ECONOMIC POLICY

In order to implement proposals of the kind outlined above it is necessary to have first of all agreement among the countries in the sub-region and secondly to have the approval of GATT as well as the European countries directly concerned. The latter is a general problem arising from the need to preserve the sub-regional market for the multi-national industries

proposed and involves discrimination against other countries. It need not be elaborated further in a paper concerned only with the basic metal industries.

Agreement among the North African countries themselves involves the location of plants; sub-regional plants in the UAR for wire rod, plate, aluminium, copper processing, in Morocco for lead processing and in Algeria for zinc, as well as multinational plants in the Maghreb for steel sheet and aluminium (Algeria) tinplate (Morocco) medium sections(Tunisia) and the plants in UAR supplying the Sudan. Duty free entry or transfer of duties would have to be agreed as well as price levels for these products.

In the longer run it is desirable to have more information on the iron ore deposits at Gara Djebilet on the coking possibilities of the coal deposits at Bechar and Abadla and on the copper deposits in the Sudan all of which are important sub-regional resources.

Table 16 : Output and capacity of proposed plants

		Existing	1970	1975	1980
A. Iron and Steel					
Morocco					
Wire drawing:	capacity	4.0	5.0	20.0	20.0
	output	2.5	5.0	13.0	20.0
Welded tube:	capacity	-	7.0	15.0	15.0
	output	-	7.0	11.0	15.0
Iron castings:	capacity	8.0	8.0	45.0	45.0
	output	5.0	8.0	30.0	45.0
Integ. bar and light sections	capacity	-	-	200.0	200.0
	output	-	-	125.0	185.0
Tinplate rolling and tinning:	capacity	-	-	-	50.0
	output	-	-	-	45.0
Forgings:	capacity	-	-	3.0	3.0
	output	-	-	2.0	3.0
Algeria					
Wire :	capacity	8.0	8.0	30.0	30.0
	output	1.0	8.0	16.0	27.0
Welded tube :	capacity	25.0	25.0	25.0	25.0
	output	9.0	9.0	9.0	16.0

Table 16 : Output and capacity of proposed plants (cont'd)

		Existing	1970	1975	1980
Algeria (cont'd)					
Iron castings:	capacity	18.0	18.0	30.0	50.0
	output	4.0	18.0	30.0	50.0
Integrated sheet and strip	capacity	-	400.0	600.0	600.0
	output	-	200.0	357.0	564.0
Semi-integrated bar and light sections:	capacity	40.0	80.0	160.0	160.0
	output	12.0	40.0	90.0	155.0
Petroleum pipe lines:	capacity	-	30.0	60.0	60.0
	output	-	30.0	47.0	60.0
Forgings:	capacity		2.0	4.0	4.0
	output		1.5	3.0	4.0
Tunisia					
Wire :	capacity		8.0	8.0	8.0
	output			5.0	8.0
Welded tube :	capacity		6.0	8.0	8.0
	output			6.0	8.0
Iron castings:	capacity		12.0	18.0	25.0
	output	2.0		13.0	22.0
Integrated iron and steel bar & light sections:	capacity	100.0	100.0	120.0	120.0
	output	70.0	70.0	80.0	115.0
Med. sections:	capacity	-		160.0	155.0
	output			90.0	
Forgings:	capacity			2.0	2.0
	output			0.6	1.0
Libya					
Wire :	capacity			10.0	10.0
	output			3.0	10.0
Welded tube:	capacity			5.0	10.0
	output			3.0	7.0
Petroleum tube:	capacity		50.0	70.0	100.0
	output		50.0	67.0	75.0
Iron castings:	capacity		5.0	10.0	25.0
	output		3.0	8.0	21.0

Table 16 : Output and capacity of proposed plants (cont'd)

		Existing	1970	1975	1980
Libya (cont'd)					
Semi-integrated bar and light sections:	capacity			60.0	60.0
	output	5.0	5.0	30.0	60.0
UAR					
Wire:	capacity		20.0	60.0	60.0
	output	9.0		45.0	66.0
Welded tube:	capacity		27.0	60.0	60.0
	output	20.0		36.0	57.0
Iron castings:	capacity		70.0	100.0	150.0
	output	50.0		97.0	150.0
Integrated bar, etc.:	capacity	sections 370		650.0	650.0
	output			298.0	624.0
Wire rod:	capacity			200.0	200.0
	output			115.0	190.0
Sheet, etc.	capacity	300.0		500.0	500.0
	output	Flats 145		318.0	492.0
Plate:	capacity			200.0	200.0
	output			100.0	160.0
Seamless tubes: possible up to 60,000 t.p.a. and petroleum tube up to 20,000 tons per annum.					
Medium sec.:	capacity			200.0	200.0
	output			135.0	215.0
Tin plate:	capacity			60.0	60.0
	output			35.0	55.0
Forgings:	capacity			15.0	15.0
	output		6.0	9.0	13.0
Sudan					
Wire:	capacity			6.0	6.0
	output		2.0	3.0	5.0
Welded tube :	capacity			8.0	8.0
	output		2.0	4.0	7.0
Iron castings:	capacity			15.0	15.0
	output		4.0	8.0	15.0

Table 16 (cont'd)

		Existing	1970	1975	1980
Sudan (cont'd)					
Semi-integrated bar and light sections:	capacity			100.0	100.0
	output			67.0	102.0
B. Non-ferrous metals					
Morocco					
Ferro-manganese:	capacity		-	50.0	50.0
	output		-	50.0	50.0
Lead ingot:	capacity	23.0	50.0	70.0	70.0
	output	18.8	50.0	57.0	63.0
rolled or extruded	capacity		10.0	20.0	20.0
	output	2.0	7.0	10.0	17.6
Zinc ingot:	capacity	-	-	50.0	50.0
	output	-	-	45.0	50.0
Scrap melting and casting of non-ferrous metal:	capacity	5.0	5.0	10.0	10.0
	output	0.7	3.0	5.5	9.3
Wire drawing:	capacity	10.0	10.0	10.0	10.0
	output	2.5	3.5	5.0	8.5
Algeria					
Zinc: ingot:	capacity	-	-	50.0	50.0
	output	-	-	40.0	50.0
Scrap melting & casting of non-ferrous metal	capacity	8.0	8.0	12.0	12.0
	output	6.0	6.0	5.7	11.5
Zinc, rolled or extruded :	capacity		-	20.0	20.0
	output		-	10.6	18.7
Wire drawing:	capacity		5.0	10.0	10.0
	output	2.3	3.5	5.0	10.0
Aluminium: rolling and extrusion:	capacity		-	60.0	60.0
	output: rolled		-	18.4	37.0
	extruded		-	9.0	18.0

Table 16 (cont'd)

		Existing	1970	1975	1980
Tunisia					
Lead: ingot	capacity	24.0	24.0	24.0	24.0
	output	13.1	24.0	24.0	24.0
Scrap melting and casting	capacity	..	1.3	4.0	4.0
	output	1.1		1.9	3.9
Wire drawing:	capacity	..		4.0	4.0
	output	..	1.2	1.7	3.6
Libya					
Scrap melting and casting	capacity	..	2.5	5.0	5.0
	output	..		2.5	5.0
Wire drawing:	capacity	..	2.2	5.0	5.0
	output	..		2.2	4.6
UAR					
Ferro-manganese:	Capacity		10.0	50.0	50.0
	output		10.0	50.0	50.0
Aluminium: ingot:	capacity		40.0	110.0	110.0
	output		24.0	61.0	110.0
rolling:	capacity	9.7	20.0	40.0	40.0
	output		15.5	22.2	34.2
extrusion	capacity		10.0	20.0	20.0
	output		7.7	11.0	11.8
Copper: rolling:	capacity	7.1	10.0	20.0	20.0
	output		6.2	8.8	15.5
extrusion :	capacity		30.0	60.0	60.0
	output		23.3	33.3	60.0
Scrap melting and casting	capacity			20.0	30.0
	output			16.2	28.0
Sudan					
Scrap melting and casting	capacity		2.0	3.0	3.0
	output		1.0	1.4	2.7
Wire drawing:	capacity		2.0	3.0	3.0
	output		1.3	1.9	2.5

ANNEX I

PRODUCTION AND CONSUMPTION OF NON-FERROUS ORES AND METALS

Consumption of aluminium

(Thousand metric tons)

	1950-1955 average	1960	1961	1962	1963	1965
Developing countries	60	156	167	202	220	239
Developed countries						
of which:	2,204	3,094	3,294	3,687	4,095	4,540
United States of America	1,407	1,541	1,791	2,089	2,340	2,535
Canada	79	110	123	128	142	160
EEC	312	703	687	735	794	889
United Kingdom of Great Britain and Northern Ireland	235	360	284	287	319	359
Japan	45	151	186	184	219	262
Others	126	229	223	264	282	335
Total a/	2,264	3,250	3,461	3,889	4,316	4,779
of which						
developing countries (per cent)	(2.7)	(4.8)	(4.8)	(5.2)	(5.1)	(5.0)
developed countries (per cent)	(97.3)	(95.2)	(95.2)	(94.8)	(94.9)	(95.0)

Source: Metallgesellschaft A.G.: Metal Statistics.

a/ Excluding the socialist countries of Eastern Europe and Asia.

Production of bauxite (gross weight)

(Thousand metric tons)

	1953-1955 average	1960	1961	1962	1963	1964	1965	1963-1965 as per cent of 1953-1955
Developing countries	9,491	17,394	19,176	20,799	19,256	20,616		
of which:								
Guiana a/	2,377	3,422	3,253	3,592	2,376	2,508	2,873	109
Guinea	417	1,378	1,767	1,758	1,664	1,433		
Jamaica	2,015	5,841	6,566	7,706	7,080	7,824	8,705	391
Surinam	3,253	3,455	3,453	3,297	3,504	3,996		
Others	1,429	3,838	4,137	4,446	4,632	4,855		
Developed countries	3,854	5,398	4,964	5,239	5,507	6,270		
of which:								
Australia	6	71	16	30	360	902		
France	1,312	2,067	2,225	2,194	2,028	2,436	2,651	181
United States of America a/	1,816	2,030	1,248	1,391	1,549	1,632	1,683	89
Others	720	1,230	1,475	1,624	1,570	1,300		
Total b/	13,345	23,332	24,140	26,038	24,763	26,886		
of which:								
developing countries (per cent)	(71.1)	(76.9)	(79.4)	(79.9)	(77.8)	(76.7)		
developed countries (per cent)	(28.9)	(23.1)	(20.6)	(20.1)	(22.2)	(23.3)		

Source: United Nations Statistical Office. Metallgesellschaft A.G.: Metal Statistics.

a/ Data represent dried equivalent of crude ore.

b/ Excluding the socialist countries of Eastern Europe and Asia.

Production of primary aluminium

(Thousand metric tons)

	1953-1955 average	1960	1961	1962	1963	1964	1965	1963-65 as per cent of 1953-55
Developing countries	19	113	118	146	174	188		
Developed countries	2,355	3,503	3,402	3,711	4,076	4,613		
of which:								
Australia	1	12	13	16	42	80		
Canada	520	691	602	626	653	764		
France	120	239	280	295	299	316	340	265
Germany (Fed. Rep.)	124	169	173	178	209	220	238	179
Japan	52	133	154	171	224	265	292	501
Norway	62	165	172	206	226	262	276	411
United States of America	1,294	1,828	1,727	1,921	2,100	2,316	2,499	178
Others	182	266	281	298	323	390		
Total[a/]	2,374	3,616	3,520	3,857	4,250	4,801		
of which:								
Developing countries (per cent)	(0.8)	(3.1)	(3.4)	(3.8)	(4.1)	(3.9)		
Developed countries (per cent)	(99.2)	(96.9)	(96.6)	(96.2)	(95.9)	(96.1)		

Source: United Nations Statistical Office.

a/ Excluding the socialist countries of Eastern Europe and Asia.

Consumption of refined copper

(Thousand metric tons)

	1953-1955 average	1960	1961	1962	1963	1964	1965[a]	1963-65 as per cent of 1953-55
Developing countries	131	210	207	253	202	315	317	227
Developed countries	2,787	3,572	3,831	3,849	4,103	4,551	4,671	159
of which:								
United States of America	1,285	1,225	1,327	1,451	1,582	1,656	1,798	131
Canada	105	107	129	138	153	183	195	169
EEC	637	1,047	1,110	1,045	1,057	1,190	1,173	179
United Kingdom of Great Britain and Northern Ireland	429	560	529	526	558	633	645	143
Japan	100	304	375	301	352	458	421	410
Others	231	329	361	388	401	431	439	183
Total[b]	2,918	3,782	4,038	4,102	4,365	4,866	4,988	162
of which:								
Developing countries (per cent)	(4.5)	(5.6)	(5.1)	(6.2)	(6.0)	(6.5)	(6.4)	
Developed countries (per cent)	(95.5)	(94.4)	(94.9)	(93.8)	(94.0)	(93.5)	(93.6)	

Source: British Bureau of Non-ferrous Metal Statistics: World non-ferrous Metal Statistics: Metallgesellschaft A.G.: Metal Statistics.

a/ Partly estimated.

b/ Excluding the socialist countries of Eastern Europe and Asia.

Production of copper ore (Cu content)

(Thousand metric tons)

	1953-1955 average	1960	1961	1962	1963	1964	1965	1963-1965 as per cent of 1953-1955
Developing countries	1,173	1,846	1,861	1,873	1,925	2,006	2,041	170
of which:								
Chile	386	536	552	590	599	630	582	156
Congo (Dem. Rep.)	224	302	295	297	271	277	288	124
Peru	39	181	198	167	178	178	178	456
Zambia	367	576	575	562	588	632	696	174
Others	157	251	241	257	289	289	297	186
Developed countries	1,343	1,764	1,849	1,933	1,928	1,997	2,109	150
of which:								
Australia	43	111	97	109	115	103	98	245
Canada	267	399	398	415	411	448	462	165
Japan	66	89	96	104	107	106	107	162
United States of America	834	980	1,057	1,114	1,101	1,132	1,229	138
Others	135	185	201	191	194	208	213	152
Total[b]	2,518	3,610	3,710	3,806	3,853	4,003	4,150	159
of which								
developing countries (per cent)	(46.6)	(51.1)	(50.2)	(49.2)	(50.0)	(49.2)		
developed countries (per cent)	(53.4)	(48.9)	(49.8)	(50.8)	(50.0)	(50.8)		

Source: United Nations Statistical Office; British Bureau of Non-Ferrous Metal Statistics: World Non-Ferrous Metal Statistics.

a/ Partly estimated.

b/ Excluding the socialist countries of Eastern Europe and Asia. Also excluding a number of small producers for which data are not available.

Production of refined copper

(Thousand metric tons)

	1953-1955 average	1960	1961	1962	1963	1964	1965[a]	1963-1965 as per cent of 1953-1955
Developing countries of which	600	910	964	1,072	1,042	1,144	1,183	187
Chile	217	226	226	263	259	278	289	127
Congo (Dem.Rep.)	111	176	205	238	198	212	200	183
Zambia	170	402	416	433	439	497	522	286
Others	102	106	117	138	146	157	172	155
Developed countries of which	2,500	3,322	3,393	3,432	3,472	3,715	3,995	149
Belgium	154	212	232	221	271	286	309	187
Canada	236	378	369	347	344	371	390	156
German (Fed.Rep.)	235	309	304	308	303	336	357	141
Japan	104	248	277	270	295	342	366	321
United Kingdom of Great Britain and Northern Ireland	214	219	238	232	214	245	256	111
United States of America	1,363	1,644	1,663	1,726	1,723	1,824	1,957	135
Others	194	312	310	328	322	311	360	171
Total[b]	3,100	4,232	4,357	4,504	4,514	4,859	5,178	156
of which								
developing countries (per cent)	(19.4)	(21.5)	(22.1)	(22.8)	(23.1)	(23.5)	(22.8)	
developed countries (per cent)	(80.6)	(78.5)	(77.9)	(76.2)	(76.9)	(76.5)	(77.2)	

Source: United Nations Statistical Office; Metallgesellschaft A.G.: Metal Statistics, British Bureau of Non-Ferrous Metal Statistics: World Non-ferrous Metal Statistics.

a/ Partly estimated.

b/ Excluding the socialist countries of Eastern Europe and Asia.

Consumption of refined lead by regions 1953-1955 (average) and 1960-1965

(Thousand metric tons)

	Average 1953-1955	1960	1961	1962	1963	1964	1965
World[a/]	1,785	2,217	2,300	2,399	2,505	2,696	2,737
Developed countries	1,684	2,052	2,106	2,187	2,267	2,414	2,445
North America	766	846	878	946	985	1,018	1,043
Western Europe	819	1,041	1,038	1,060	1,070	1,142	1,161
Oceania and South Africa	56	66	64	63	82	90	84
Japan	43	100	126	118	130	164	157
Developing countries	101	165	195	212	238	282	292
Latin America	64	98	114	113	125	140	149
Asia and Far East	19	38	41	50	56	76	78
Africa	7	6	5	10	6	16	15
Yugoslavia	11	23	35	39	50	50	50

a/Excluding the socialist countries of Eastern Europe and Asia.

Production of lead ores and concentrates by regions 1953-1955(average) and 1960-1965

(Thousand metric tons metal content)

	Average 1953-1955	1960	1961	1962	1963	1964	1965
World[a/]	1,753	1,810	1,768	1,854	1,865	1,891	2,033
Developed countries	1,106	1,119	1,111	1,201	1,216	1,234	1,318
North America	490	420	413	416	420	460	552
Western Europe	234	286	311	282	255	249	261
Oceania and South Africa	359	373	341	449	488	471	450
Japan	23	40	46	54	53	54	55
Developing countries	647	691	657	653	649	657	715
Latin America	387	393	396	388	287	401	415
Asia and Far East	34	46	44	44	44	43	49
Africa	140	159	122	125	117	111	154
Yugoslavia	86	93	95	96	101	102	97

a/Excluding the socialist countries of Eastern Europe and Asia.

Production of refined lead by regions 1953-1955 (average) and 1960-1965

(Thousand metric tons)

	Average 1953-1955	1960	1961	1962	1963	1964	1965
World[a/]	1,995	2,303	2,371	2,320	2,457	2,568	2,621
Developed countries	1,554	1,840	1,888	1,841	1,958	2,092	2,125
North America	728	788	873	797	828	908	902
Western Europe	597	769	750	744	785	805	832
Oceania and South Africa	198	209	182	208	244	271	282
Japan	31	74	83	92	101	108	109
Developing countries	441	463	483	479	499	476	496
Latin America	286	281	305	297	313	302	309
Asia and Far East	15	29	27	27	30	30	30
Africa	69	64	61	57	52	43	55
Yugoslavia	71	89	90	98	104	101	102

a/Excluding the socialist countries of Eastern Europe and Asia.

Consumption of slab zinc by regions 1953-1955 (average) and 1960-1965

(Thousand metric tons)

	Average 1953-1955	1960	1961	1962	1963	1964	1965
World[a/]	2,032	2,472	2,622	2,726	2,958	3,243	3,390
Developed countries	1,944	2,271	2,406	2,484	2,663	2,936	3,075
North America	948	860	946	1,014	1,107	1,173	1,362
Western Europe	818	1,100	1,129	1,121	1,130	1,252	1,254
Oceania and South Africa	79	123	103	115	132	155	147
Japan	99	189	228	234	295	356	312
Developing countries	88	201	216	242	295	307	315
Latin America	46	81	85	92	123	137	144
Asia and Far East	31	90	100	117	130	130	130
Africa	1	3	4	4	5	5	6
Yugoslavia	9	27	27	29	37	35	35

a/Excluding the socialist countries of Eastern Europe and Asia.

Production of zinc ores and concentrates by regions 1953-1955 (average) and 1960-1965

(Thousand metric tons metal content)

	Average 1953-1955	1960	1961	1962	1963	1964	1965
World[a/]	2,239	2,563	2,649	2,803	2,859	3,203	3,478
Developed countries	1,627	1,808	1,894	1,985	2,035	2,321	2,486
North America	831	824	865	959	979	1,240	1,434
Western Europe	418	518	552	499	513	515	478
Oceania and South Africa	273	309	309	334	345	349	353
Japan	105	157	168	193	198	217	221
Developing countries	712	755	755	818	824	882	992
Latin America	445	474	489	520	532	541	596
Asia and Far East	11	20	18	19	20	35	43
Africa	197	205	188	218	211	240	286
Yugoslavia	59	56	60	61	61	66	67

a/Excluding the socialist countries of Eastern Europe and Asia.

Slab zinc production by regions 1960 to 1965

(Thousand metric tons)

	1960	1961	1962	1963	1964	1965
World[a/]	2,439	2,570	2,653	2,742	2,959	3,124
Developed countries	2,218	2,344	2,409	2,464	2,671	2,832
North America	1,028	1,061	1,105	1,121	1,237	1,303
Western Europe	887	930	888	878	930	960
Oceania and South Africa	122	141	171	183	188	202
Japan	181	212	245	282	316	367
Developing countries	221	226	244	278	288	292
Latin America	103	101	108	132	142	144
Africa	82	88	97	104	101	102
Yugoslavia	36	37	39	42	45	46

a/Excluding the socialist countries of Eastern Europe and Asia.

ANNEX II

PRODUCTION, DEMAND, EMPLOYMENT AND INVESTMENT 1960-80

Note on valuation of output

Only in a few cases are production figures given in value so that in most cases it has been necessary to value the output in tons by average export prices where the commodity is usually exported or at import prices where it is normally imported. It is also necessary to avoid duplication in the value of the output of a sector since for example tubes are usually made from imported strip, wire drawn from imported rod and so on. The figures given in the tables are net figures in this sense and the average values used for the purpose failing published figures and based mainly on import are as follows:

	Gross value	(normal) value added	Main material used $ per ton
Iron & steel[a]			
Iron castings	200	60	25 (scrap)
Forgings	400	200	150
Wire	150	30	100
Tubes	200	30	150
Bar from scrap	100	32	25 (scrap)
Integrated bar	100	32	-
Integrated sheet	150	78	-
Tin plate	220	60	120 (h.r. coil)
Non-ferrous			
Castings	2,000	700	- (scrap)
Wire	1,600	400	800
Lead tubes	500	350	- (scrap)
Refining: lead/zinc	300	75	- (scrap)
copper & alum.	800/500	150	- (scrap)
Lead/zinc: production	300	100	- (ore)
rolling, etc.	500	150	- (bar)
Aluminium: production	500	200	- (alumina)
extrusion	700	150	- (bar)
Aluminium: rolling, etc.	1,000	400	- (slab)
Copper: rolling and extrusion	950		800 [b]

a/ All products and qualities not produced in the sub-region are valued at one-third above this price equivalent to 5 per cent in total.

b/ United States maximum price is $920 per ton.

For iron and steel the prices of materials used are actual prices and value added a residual which is lower than the 'normal' given above for integrated operations but higher in the use of foundry production. For non-ferrous metals the prices of materials used are residuals after allowing a 2 per cent return on capital.

For iron castings capital investment per annual ton is taken at $100 and man hours at 50; for tin plate from hot rolled coil $250 and 10 manhours.

Production, demand, employment and investments: 1960-1980

Country: Morocco
Industry: ISIC No. 341 Iron and Steel
SITC No: In brackets

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity										
Wire drawing (677)	tons					4,000		5,000	20,000	20,000
Welded tube (678)	tons					-		7,000	15,000	15,000
Iron castings (679)	tons					7,600		8,000	40,000	40,000
Forgings (679)	tons					750		-	2,000	2,000
Finished steel (672/6) bar	tons					-		-	200,000	200,000
tinplates									50,000	50,000
2. Gross output										
(a) Value	$'000	1,970	1,900	2,170	2,280	2,460	2,480	4,850	23,450	44,600
			(net)		(1,840)	(2,040)	(2,040)	(3,000)	(20,200)	(34,500)
(b) Quantity	tons	7,680	7,000	7,630	8,060	8,540	8,690[a]	16,800	181,000	313,000
			(net)		(3,600)	(4,300)	(4,500)	(8,000)	155,000	230,000
3. Value added	$'000				930	990	1,000	1,000	5,390	10,230
2/3. Types										
Wire	tons				2,360	2,515	2,660			
Value	$'000				280	305	320			
Rod used	$'000				240	250	270			
Value added										
Castings	tons				5,100	5,400	5,400			
Value	$'000				1,700	1,840	1,840			
pig iron	$'000				108	75	70			
Imports	tons				1,490	1,080	940			
Value added	$'000				710	760	760			
Forgings	tons				600	630	630			
Value	$'000				300	315	315			
Bar used	$'000				90	95	95			
Value added	$'000				150	160	160			

Country: Morocco (Cont'd)

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
4. Exports										
(a) Value	$'000	-	-	-	-	-	-	-	-	7,000
(b) Quantity	tons	-	-	-	-	-	-	-	-	32,000
5. Imports										
(a) Value	$mln.				23.8	28.0	22.7	33.0	32.8	52.3
(b) Quantity	'000 tons				150.5	186.0	138.5	244	215	327
6. Domestic demand (= 2 + 5 - 4)										
(a) Value	$mln.				25.6	30.1	24.7	36.0	53.0	79.8
(b) Quantity	'000 tons (net)				154.1	190.3	143.9	252	370	557
7. Employment	number									
Total of which:						970		250	1,640	2,690
Administrative						30			65	106
Technical						10			65	106
Foremen						20			65	106
Clerical						150			295	480
Operative:										
skilled)						760			885	1,442
unskilled)									265	430
8. Fixed capital formation	$'000								1970-1975	1975-1980
Total of which:						136			(new)62,000	15,000
Buildings						16			20,000	5,000
Machinery						118				
Vehicles						2			42,000	10,000

a/ Part estimated.

Production, demand, employment and investments 1960-1980

Country: Algeria
Industry: ISIC No.341

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity										
Crude steel (672)	tons					30,000			800,000	800,000
Rolled steel (673/6) (bar)	tons					40,000		80,000	150,000	150,000
Wire (677)	tons					8,000		10,000	30,000	30,000
Tube (678)	tons					25,500		55,000	25,000	25,000
Castings (679)	tons					18,000		18,000	30,000	50,000
Rolled steel (wide strip)								400,000	600,000	600,000
2. Gross output										
(a) Value	$'000 (net)	7,800	6,600	2,960	2,590	3,470		net	83,800 (73,350)	131,850 (117,150)
(b) Quantity	tons (net)	48,700	38,300	11,700	81,200	20,500		net	556,000 (477,000)	882,000 (769,000)
Type										
Crude steel	tons	31,034	30,535	5,507	9,480	19,790	23,016			
Rolled steel	tons	40,446	31,113	7,474	7,465	16,728	28,860			
Tubes	tons	1,232	7,317	7,033	8,864	(7,000)	5,704			
Castings	tons	8,321	7,181	4,402	3,868	(4,000)				
Wire	tons	2,390	1,950	1,080	465	(500)				
3. Value added				1,180	1,130	1,455		16,000	28,480	44,850
4. Exports										
(a) Value				360	476	249		15,000	33,600	53,400
(b) Quantity				2,080	3,974	2,006		100,000	224,000	350,000
5. Imports										
(a) Value				29,100	34,810	41,720		24,700	23,200	36,300
(b) Quantity				152,710	146,750	175,140		143,000	140,000	217,000

Country: Algeria (Cont'd)

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
6. Domestic demand (= 2 + 4 - 4)										
(a) Value	$1,000			31,700	36,910	44,940		44,100	63,000	100,100
(b) Quantity	tons			162,330	153,880	193,500		275,000	393,000	636,000
7. Employment total, of which								2,300	3,300	5,500
8. Fixed capital formation	$'000						X6-2+4 new (1965-70)	125,000	(1970-1980)	100,000

Production, demand, employment and investment, 1960-1980

Country: Tunisia
Industry: ISIC No.341

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity iron castings	'000 tons				5.3	..	6.0	..		
2. Gross output value	$'000	400	300	380 (net)	420 (410)	510 (970)	600 (460)	4,800 2,400	23,600 (22,000)	37,300 (35,600)
Quantity	'000 tons	1.34	0.99	1.28	1.36	1.7	2.0	12.0	180.0	292.0
3. Value added	$'000	190	140	170	200	240	280	1,140	6,670	10,160
4. Exports										
Value				-	-	-	-	-	8,500	14,600
Quantity				-	-	-	-	-	71.0	122.0
5. Imports										
Value	$'000				13,100	14,120	18,310	15,500	13,100	20,000
Quantity	'000 tons				74.2	86.7		118.0	84.0	129.0
6. Domestic demand (= 2 + 5 - 4)										
Value	$'000				13,500	14,590	19,770	17,900	26,600	41,000
Quantity (net)	'000 tons				75.5	88.0	118.7	130.0	196.0	299.0
7. Employment total of which						150		310	1,340	2,480
								new 1965-70	1970-75	1975-80
8. Fixed capital formation	$'000							40,000	51,000	200

Production, demand, employment and investments 1960-1980

Country: Libya
Industry: ISIC No. 341
SITC No:

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity										
2. Gross output										
Value	$'000				500	500	500		19,050	28,100
Quantity	tons				5,000	5,000	5,000		(8,250)*	(14,800)
									38,000*	81,000
3. Value added	$'000				300	300	300		3,630	4,940
4. Exports										
Value										
Quantity										
5. Imports										
Value	$'000				25,745	26,750	27,270	36,050	25,550	45,500
Quantity	tons				117,870	145,500	139,330	225,000	153,000	268,000
6. Domestic demand (= 2 + 5 - 4)										
Value					26,245	27,250	27,770	39,550	33,800	60,300
Quantity					122,870	150,500	144,330	233,000	191,000	349,000
7. Employment, total										
of which						80			515	1,250
									1970-75	1975-80
8. Fixed capital formation								(new)	23,350	3,500

* net.

Production, demand, employment and investment 1960-80

Country: United Arab Republic
Industry: ISIC No.341

	Units	1960	1961	1962	1963	1964 (estimated)	1965	1970	1975	1980
1. Capacity										
2. Gross output						89.0		87.2	164.8	273.3
Value	$mln.					net 81.4		79.6	150.3	251.0
	'000					380		638	1,222	2,072
Quantity	tons					net325		585	1,144	1,897
3. Value added	$mln.					-		29.5	66.3	103.7
4. Exports										
Value	$mln.					3.3		14.6	20.9	36.8
Quantity	'000 tons					2.0		129	184	310
5. Imports										
Value	$mln.					40.2		48.0	40.2	47.5
Quantity	'000 tons					265		335	227	253
6. Domestic demand (finished steel and castings) (= 2 + 5 - 4)										
Value	$mln.					118.3		113.0	169.6	261.7
Quantity	'000 tons					588		791	1,187	1,840
7. Employment, total								5,100	9,400	14,800
of which										
Managers and senior technicians									380	590
Junior technicians and foremen									2,440	3,850
Skilled and semi-skilled operators									5,080	7,990
Unskilled operators									1,500	2,310
8. Fixed capital formation	$mln.					new		385		

Production, demand, employment and investments 1960-1980

Country: Sudan
Industry: ISIC No. 341

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity										
2. Gross output										
Value (gross)	$mln.							1.5	9.5	15.3
(net)								1.0	5.9	9.8
Quantity (gross)	'000							8	82	129
(net)	tons							4	43	65
3. Value added	$mln.							0.4	2.8	4.5
4. Exports										
Value										
Quantity										
5. Imports										
Value	$mln.				9.9	13.1	7.1	12.2	13.4	23.0
Quantity	'000 tons				62.9	104.4	52.6	96.0	107.0	180.0
6. Domestic demand (= 2 + 5 - 4)										
Value	$mln.							13.2	19.3	32.8
Quantity	'000 tons							100	150	245
7. Employment, total								110	560	900
of which										
8. Fixed capital formation	$mln.							new 1970-80	20	

Production, demand, employment and investment 1960-80

Country: Morocco
Industry: ISIC No. 342 Non-ferrous metals
SITC No.:

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity										
Lead metal (685)	tons					15,000		50,000	70,000	70,000
Zinc metal (686)	tons					-			50,000	50,000
Non-ferrous foundry (682/7)	tons					750		800	10,000	10,000
Aluminium bar and sheet (684)	tons					550		600		
Lead sheets and tubes (685)	tons					1,600			20,000	20,000
Copper and aluminium wire (682/4)	tons					1,400			10,000	10,000
Ferro-manganese	tons								50,000	50,000
2. Gross output										
Value (gross)	$'000				10,130	9,550	10,160	27,400	59,200	78,000
(net)	$'000				6,220	6,160	6,540	21,800	52,500	65,900
Quantity (net)	'000 tons				18.8	18.8	17.2	53.0	157.5	172.5
3. Value added	$'000				3,125	2,975	2,915		18,900	24,500
2/3Types										
Lead	'000 tons				18.8	18.8	17.2	50	57	63
Value pb	$'000				2,430	2,600	3,160		17,100	18,900
ag					700	700	700		(4,000)	(4,500)
Value added	$'000				1,200	1,200	1,100		5,700	6,300
Castings	tons				1,080	550	500	3,000	5,500	9,800
Value	$'000				2,160	1,100	1,000		11,000	18,600
Value metal	$'000				760	380	350		6,500	6,500
Value added	$'000				430	220	200		2,750	4,650
Ferro-manganese value	$'000								6,500	6,500
Value added									2,500	2,500

Country: Morocco (Cont'd)

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
Zinc	'000 tons								45	50
Value	$'000								13,500	15,000
Value added	$'000								4,500	5,000
Wire	tons					2,500	-	4,000	5,000	8,500
Value	$'000					4,000	-		6,000	10,200
Value rod used	$'000					2,750	-		4,000	6,800
Value added	$'000					1,000	-		2,000	3,400
Lead tubes (rolled and extruded)	tons					600		8,000	9,500	17,600
Value						300			4,750	8,800
Value metal						120			2,850	5,280
Value added						215			1,420	2,640
Aluminium bar etc.	tons				270	330	390			
Value					590	720	850			
Value plate					270	330	390			
Value added					280	360	420			
4. Exports										
Value	$'000				2,430	2,600	3,160	15,900	38,500	42,000
Quantity	tons				14,300	17,170	14,300	48,500	190,100	159,100
5. Imports										
Value	$'000				5,186	5,370	6,280	16,100	17,100	32,700
Quantity	tons				6,440	5,892	5,044	14,500	21,300	37,600
6. Domestic demand (= 2 + 5 - 4)										
Value	$'000				9,380	8,930	9,660	22,000	32,400	56,600
Quantity	'000 tons net				10.9	7.5	7.9	19.0	29.2	50.6
7. Employment, total						500		65.0	1,200	1,600
of which										
Administrative						18			50	63
Technical						25)				
Foremen						50)			328	415
Clerical						36)				

Country: Morocco (Cont'd)

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
Operative skilled						110)			126	1,122
Unskilled						260)				
8. Fixed capital formation, total of which	$'000							new 1965-80		98,700
Buildings						22				
Machinery						148				
Vehicles						130				

a/ Lead at export price and includes 0.1 per cent silver @ $48,000 per ton.

Production, demand, employment and investment 1960-80

Country: Algeria
Industry: ISIC No.342
SITC No.:

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity	(tons)					1,000				
Foundry									12,000	12,000
Castings									50,000	50,000
Zinc metal									10,000	10,000
Wire						6,300				
Copper wire						2,000				
Aluminium wire						2,000				
Refined lead						600				
Aluminium						?				
Copper						3,500				
Lead tubes						1,200			60,000	60,000
Rolled aluminium									20,000	20,000
Rolled and extruded zinc	(official)					(4,280)				
2. Gross output	$'000									
Value (gross)				4,495	3,545	4,670		14,200	59,100	108,850
Value (net)				1,900	1,770	2,500		11,400	40,500	69,800
Quantity (net)	tons (official)			1,300	1,970	2,650		5,000	46,000	62,000
						2,210				
3. Value added	$'000			1,381	1,250	1,620			17,500	32,500
Type:										
Wire	tons	4,250	4,860	2,230	1,420	1,750		3,500	5,000	10,000
Copper		(3,580)	(3,620)	(2,020)	(1,370)	(1,500)				
Aluminium		(672)	(1,240)	(210)	(50)	(200)				
Value		6,800	7,780	3,570	2,270	2,720		4,200	6,000	12,000
Value metal		4,675	5,350	2,450	1,560	1,870				
Value added		1,700	1,940	850	570	680			2,000	4,000

Country: Algeria (Cont'd)

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
Zinc										
Quality	tons							-	40,000	50,000
Value	$'000							-	12,000	15,000
Value added								-	4,000	5,000
Refined metal	tons									
Lead		-	550	700	1,280	1,390	Rolled or extruded			
Aluminium		50	110	70	160	(200)	zinc	tons	10,600	18,700
Copper		?	?	?	?	(6,500)		value (net)	2,100	3,700
Value		35	240	260	500	920				
Metal used		2	100	100	190	370				
Value added		100	120	150	260	420				
Lead tube	tons	2,550	1,630	450	470	460				
Value		1,275	815	225	235	230	(incl. under foundry)			
Metal		255	163	45	47	46				
Value added		890	570	140	160	150				
Rolled aluminium	tons	420	580	140	210	(300)	Rolled or extruded		28,000	55,000
Value	$'000	840	1,160	280	420	600			25,300	49,600
Metal		420	580	140	210	300				
Value added		420	580	140	210	300				
Foundry	tons	-	120	80	60	(100)		5,000	5,700	11,500
Value	$'000							10,000	11,400	23,000
Metal			240	160	120	200				
Value added			80	60	40	700				
4. Exports										
Value	$'000			(268)	268	(268)		270	29,700	47,100
Quantity	tons			(670)	670	(670)		700	59,600	79,700

Country: Algeria (Cont'd)

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
5. Imports										
Value	$'000			(3,210)	2,757	(3,860)		12,600	23,900	46,700
Quantity	tons			(6,500)	4,323	(5,400)		17,400	44,900	79,200
6. Domestic demand (= 2 + 5 - 4)										
Value	$'000			4,840	4,260	6,090		23,800	34,700	69,400
Quantity	tons			7,130	5,620	7,380		21,700	31,250	61,500
7. Employment, total										
of which								550	3,300	6,300
8. Fixed capital formation	$'000						new 1965-80		82,200	

Production, demand, employment and investment 1960-80

Country: Tunisia
Industry: ISIC No. 342
SITC No.

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity	(tons)									
Lead metal						24,000			24,000	24,000
Zinc						-			-	-
Non-ferrous								Castings	4,000	4,000
Foundry						100				
Lead, tubes and shots						3,000		wire, drawing	4,000	4,000
2. Gross output	$'000									
Value (gross)		4,296	4,226	3,712	3,468	3,483	5,072	11,200	13,700	20,800
(net)		(4,159)	(4,108)	(3,520)	(3,250)	(3,279)	(4,868)	10,200	11,700	16,400
Lead		3,922	3,758	3,240	2,900	2,955	4,544			
Tubes, etc. (gross)		274	336	384	436	408	408			
(net)		(137)	(118)	(192)	(218)	(204)	(204)			
Foundry		100	132	88	132	120	120			
Quantity:	tons									
Lead		17,463	20,726	17,900	13,610	11,500	14,200	26,500	27,600	31,500
Tubes		510	784	840	970	850	1,020	25,300	26,500	27,900
Shot		176	55	120	120	170		(net)		
Foundry		50	66	44	66	60				
3. Value added		1,309	1,563	1,382	1,166	1,017	1,187	3,000	3,800	4,870
Lead		1,102	1,304	1,128	857	725	895			
Other		207	159	254	309	292	292			
4. Exports										
Value	$'000									
Lead		3,245	3,456	2,430	2,224	2,998	4,613	7,200	7,200	7,200
Other		100	114	130	197	120	112			
Quantity:	tons									
Lead		16,710	19,046	15,233	13,079	10,766	14,300	24,200	24,000	24,000
Other		255	231	331	346	207	230			

Country: Tunisia (Cont'd)

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
5. Imports										
Value	$'000	760	917	845	1,103	1,513	1,625	4,300	6,200	14,400
Quantity	tons	940	1,129	1,000	1,609	1,374	1,384	5,300	8,300	17,400
6 Domestic demand (= 2 + 5 - 4)										
Value		1,574	1,455	1,805	1,982	1,894	1,768	7,300	11,300	23,600
Quantity		1,305	2,570	3,340	1,850	1,960	1,110	6,680	10,200	21,300
7. Employment, total of which								600	1,400	1,800*
8. Fixed capital formation	$'000							new 1965-80	600	

* Including existing foundry.

Production, demand, employment and investments 1960-80

Country: Libya
Industry: ISIC No. 342
SITC No.:

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity	tons									
Foundry									5,000	5,000
Wire, drawing									5,000	5,000
2. Gross output										
Value (gross)	$'000							7,600	7,640	15,500
(net)								5,900	5,900	11,800
Quantity (net)	tons							2,550	2,500	5,000
3. Value added	$'000							850	850	1,870
4. Exports										
Value										
Quantity										
5. Imports										
Value					457	858	1,239	12,200	9,200	17,700
Quantity					968	1,269	2,131	12,180	10,500	21,600
6. Domestic demand (= 2 + 5 - 4)										
Value	$'000							18,150	15,100	29,500
Quantity	tons							14,600	13,000	26,600
7. Employment, total								270	270	600
of which										
8. Fixed capital formation	$'000						new 1975-80		3,500	

Estimated 1964-1965 production, demand, employment and investments

Country: United Arab Republic
Industry: ISIC No. 242
SITC No.:

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity	tons									
Ferro-Manganese									50,000	50,000
Aluminium: ingot									110,000	110,000
Rolling and extrusion									60,000	60,000
Copper: rolling and extrusion									80,000	80,000
Foundry									20,000	30,000
2. Gross output										
Value (gross)	$'000							71,500	117,500	207,400
(net)								47,900	288,000	148,200
Copper							7,000			
Aluminium							9,600			
Lead							1,800			
Quantity: (net)	tons							39,500	127,200	188,000
Copper							7,050			
Aluminium							9,700			
Lead							3,500			
3. Value added									28,000	36,800
4. Exports										
Value								-	42,800	77,300
Quantity								-	101,200	150,600
5. Imports										
Value	$'000							22,100	55,800	97,100
Copper							440			
Aluminium							1,350			
Lead							10			
Zinc							240			
Other							58			
Quantity	tons							28,500	64,700	113,600
Copper							300			
Aluminium							1,000			

Country: United Arab Republic (Cont'd)

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
Lead	tons						20			
Zinc							490			
Other							30			
6. Domestic demand (= 2 + 5 - 4)										
Value total	$'000							70,000	101,000	168,000
Quantity	tons						20,500	63,000	90,300	150,500
Copper							7,350			
Aluminium							10,100			
Lead							3,520			
Zinc							490			
Other							30			
Total							23,400			
7. Employment, total								3,900	5,500	9,400
Administration									220	380
Technicians and foremen									1,430	2,440
Operators									3,850	6,580
8. Fixed capital formation	$'000									
							new 1965-80	———	127,500	

Production, demand, employment and investments 1960-1980

Country: Sudan
Industry: ISIC No.342
SITC No.:

	Units	1960	1961	1962	1963	1964	1965	1970	1975	1980
1. Capacity	tons									
Foundry									3,000	3,000
Wire, drawing									3,000	3,000
2. Gross output										
Value (gross)								3,560	5,150	8,400
(net)								2,520	3,600	6,400
Quantity (net)								1,000	1,400	2,700
3. Value added								350	430	820
4. Exports										
Value										
Quantity										
5. Imports										
Value	$'000				1,205	1,263	1,317	3,080	4,500	9,900
Quantity	tons				1,574	1,689	1,564	4,100	6,000	12,000
6. Domestic demand (= 2 + 5 - 4)										
Value	$'000							5,600	8,100	16,300
Quantity	tons							5,100	7,400	14,700
7. Employment, total, of which								140	180	300
8. Fixed capital formation	$'000								2,100	

ANNEX III

OUTPUT AND INPUT STRUCTURE

Country: Any country subject to variations in total, in exports, and perhaps in mining

Distribution in gross output of industry ISIC No. 341. *Year 1964 - no export
1980 - exports

Gross output supplied to:		
Final destination, total		-
Consumption: a. private		-
b. public		-
Fixed capital formation		-
Changes in stocks (+ or -)		
Exports		*
Intermediate destination, total		100.0
Ind. 0	Agriculture, etc.	2
1	Mining and quarrying	2
20) 21) 22)	Food manuf. ind.	1
23		-
24		-
25		-
26		-
27		-
28		-
29		-
30		-
31		-
32		-
33		-
34		1
35		50
36/37		25
38		13
39		-
4		5
5		-
61		-
62/63		-
64		-
7		1
8/9		-
Total gross output		100.0

Input structure of industry ISIC No. 341, Year 1980

		Tunisia absolute	Co-efficient	Libya absolute	Co-efficient
0	Agriculture, etc.				
1	Mining and quarrying	1,600	0.0341		
20	Food manufacturing industry				
21					
22					
23					
24					
25					
26					
27					
28		175	0.0037	80	0.0030
29					
30					
31		400	0.0085	100	0.0037
32		5,895	0.1256	280	0.0105
33		2,180	0.0464	740	0.0277
34		3,540	0.0754	13,690	0.5119
35		455	0.0097	250	0.0094
36/37		625	0.0133	395	0.0148
38		300	0.0064	160	0.0060
39		600	0.0128	160	0.0060
4					
5		3,950	0.0841	1,275	0.0477
61					
62/63		2,055	0.0438	1,195	0.0447
64					
7		2,090	0.0445	620	0.0232
8/9					
	Total intermediate inputs	23,865	0.5083	18,945	0.7086
	Salaries and wages	4,775	0.1016	2,420	0.0905
	Rest wo per cent	18,295	0.3901	5,370	0.2009
	Total gross output	49,935	1.0000	26,735	1.0000
	(At 1964 prices)	(37,700)		(28,100)	

Input structure of industry ISIC No. 342 including ferro-manganese, Year 1980

		Tunisia absolute	Co-efficient	Libya absolute	Co-efficient
0	Agriculture, etc.				
1	Mining and quarrying				
20	Food manufacturing industry				
21					
22	Coke	750	0.0389	180	0.0116
23	Electricity	530	0.0275	145	0.0094
24	Refractories	180	0.0093	50	0.0032
25	Petroleum	40	0.0021	40	0.0026
26	Chemicals	40	0.0021	40	0.0026
27	Machinery	100	0.0052	100	0.0065
28	Metal products	100	0.0052	100	0.0065
29	Transport	50	0.0026	50	0.0032
30	Services	1,200	0.0622	1,235	0.0797
31	Total	2,990	0.1549	2,040	0.1316
32					
33					
34	Scrap metal	5,050	0.2616	6,850	0.4394
35	Basic metal	3,910	0.1922	4,780	0.3084
36/37	Ore and concentrate	2,680	0.1389	-	-
38					
39	Total intermediate	14,430	0.7476	13,630	0.0794
4	Salaries and wages	2,050	0.1062	1,170	0.0755
5	Capital 20%	2,820	0.1462	700	0.0451
61	Total gross output	19,000	1.0000	15,500	1.0000
62/63					
64					
7					
8/9					
	Total intermediate inputs				
	Salaries and wages				
	Indirect taxes less subsidies				
	Rest				
	Total gross output				

Input structure of industry ISIC No. 341, Year 1980

		Morocco absolute	Co-efficient	Algeria absolute	Co-efficient
0	Agriculture, etc.				
1	Mining and quarrying	1,100	0.0219	4,000	0.0302
20	Food manufacturing industry				
21					
22					
23					
24					
25					
26					
27					
28		150	0.0030	600	0.0045
29					
30					
31		400	0.0080	1,020	0.0077
32		4,210	0.0839	15,460	0.1165
33		1,965	0.0392	4,770	0.0360
34		13,075	0.2607	19,550	0.1473
35		550	0.0110	1,640	0.0124
36/37		785	0.0157	1,890	0.0143
38		300	0.0060	1,390	0.0105
39		500	0.0100	1,390	0.0105
4					
5		2,185	0.0436	4,810	0.0363
61					
62/63		2,505	0.0499	1,690	0.0580
64					
7		1,515	0.0302	6,605	0.0498
8/9					
	Total intermediate inputs	29,240	0.5830	70,810	0.5340
	Salaries and wages	5,125	0.1022	16,240	0.1224
	Rest, 20% capital	15,785	0.3148	45,570	0.3436
	Total gross output	50,150	1.0000	132,620	1.0000
	(At 1964 prices)	(44,600)		(131,100)	

Input structure of industry ISIC No.342 + ferro manganese, Year 1980

		Morocco value	Input co-efficient	Algeria value	Input co-efficient
0	Agriculture, etc.				
1	Mining and quarrying				
20	Food manufacturing industry				
21					
22					
23	Coke	3,900	0.0500	1,700	0.0157
24	Electricity	3,500	0.0449	1,000	0.0092
25	Refractories	1,000	0.0128	500	0.0046
26	Petroleum	200	0.0026	300	0.0028
27	Chemicals	200	0.0026	300	0.0028
28	Machinery	500	0.0064	1,500	0.0138
29	Metal products	500	0.0064	1,000	0.0092
30	Transport	200	0.0026	300	0.0028
31	Services	3,000	0.0385	4,000	0.0368
32	Scrap metal (residual)	13,000	0.1667	15,500	0.1427
33	Basic metal (residual)	16,000	0.2050	46,100	0.4244
34	Ore and concentrate (residual)	13,000	0.1667	3,000	0.0276
35					
36/37	Total intermediate	55,000	0.7052	75,700	0.6924
38	Salaries and wages	3,000	0.0385	18,200	0.1676
39	Capital 20%	20,000	0.2563	15,200	0.1400
4	Total gross output	78,000	1.0000	108,700	1.0000
5					
61					
62/63					
64					
7					
8/9					
	Total intermediate inputs				
	Salaries and wages				
	Indirect taxes less subsidies rest				
	Rest				
	Total gross output				

Input structure of industry ISIC No. 341, Year 1980

		UAR absolute	UAR Co-efficient	Sudan absolute	Sudan Co-efficient
0	Agriculture, etc.				
1	Mining and quarrying	10,490	0.0408		
20	Food manufacturing industry				
21					
22					
23					
24					
25					
26					
27					
28		700	0.0027	75	0.0045
29					
30					
31		2,680	0.0104	70	0.0042
32		47,680	0.1854	230	0.0138
33		12,570	0.0488	620	0.0373
34		32,675	0.1270	6,920	0.4160
35		3,225	0.0125	230	0.0138
36/37		4,220	0.0164	280	0.0168
38		2,455	0.0095	140	0.0084
39		1,555	0.0138	140	0.0084
4					
5		2,015	0.0078	880	0.0529
61					
62/63		15,220	0.0591	920	0.0553
64					
7		11,930	0.0464	1,045	0.0628
8/9					
	Total intermediate inputs	149,415	0.5806	11,550	0.6943
	Salaries and wages	16,085	0.0637	1,035	0.0622
	Rest, 20% capital	91,520	0.3557	4,050	0.2435
	Total gross output	257,320	1.0000	16,635	1.0000
	(At 1964 prices)	(273,300)		(15,150)	

Input structure of industry ISIC No.342 + ferro manganese, Year 1980

		UAR absolute	Co-efficient	Sudan absolute	Co-efficient
0	Agriculture, etc.				
1	Mining and quarrying				
20	Food manufacturing industry				
21					
22					
23	Coke	2,400	0.0116	100	0.0119
24	Electricity	10,600	0.0512	85	0.0101
25	Refractories	2,000	0.0097	35	0.0042
26	Petroleum	500	0.0024	20	0.0024
27	Chemicals	3,000	0.0145	20	0.0024
28	Machinery	7,000	0.0338	50	0.0060
29	Metal products	2,000	0.0097	50	0.0060
30	Transport	500	0.0024	30	0.0036
31	Services	10,400	0.0502	825	0.0982
32	Total	38,400	0.1855	1,215	0.1446
33	Scrap metal	41,000	0.1981	3,700	0.4405
34	Basic metal	64,500	0.3116	2,670	0.3179
35		26,100	0.1261	-	-
36/37	Total intermediate	170,000	0.8213	7,585	0.9030
38	Salaries and wages	11,500	0.0556	395	0.0470
39	Capital	25,500	0.1201	420	0.0500
4	Gross output	207,700	1.0000	8,400	1.0000
5					
61					
62/63					
64					
7					
8/9					
	Total intermediate inputs				
	Salaries and wages				
	Indirect taxes less subsidies				
	Rest				
	Total gross output				

Wire drawing and wire products

Country: Morocco
Input structure of industry ISIC No.341
Year 1964

	Absolute values $'000		Input coefficients
	Total	of which imported	2 as % of 1
0			
1			
20			
21			
22			
23			
24			
25			
26	2		.0018
27	4		.0035
28			
29			
30	2		.0018
31	4		.0035
32	14		.0124
33	2		.0018
34	644		.5689
35	10		.0088
36/37	2		.0018
38			
39			
4			
5	20		.0177
61)			
62/63)			
64)			
7)	4		.0035
8/9) ex.7	32		.0283
Total intermediate inputs	740		.6537
Salaries and wages	252		.2226
Indirect taxes less subsidies	60		.0530
Depreciation	20		.0177
Profit	60		.0530
Total gross output	1,132		1.0000

Ferrous and non-ferrous foundry

Country: Morocco
Input structure of industry ISIC No. 341/342
Year 1964

	Absolute values		Input coefficients
	Total	of which imported	2 as % of 1
0			
1	152		.0475
20			
21			
22			
23			
24	2		.0007
25	8		.0025
26			
27	6		.0019
28			
29	2		.0007
30	6		.0019
31	28		.0087
32	96		.0300
33	28		.0087
34	859		.2665
35	82		.0256
36/37			
38	4		.0013
39			
4	6		.0019
5	56		.0175
61)			
62/63)			
64)	50		.0156
7)	30		.0094
8/9) ex. 7964	120		.0374
Total intermediate inputs	1,530		.4778
Salaries and wages and soc. charges	1,162		.3629
Indirect taxes less subsidies	166		.0518
Depreciation	38		.0119
Profit	306		.0956
Total gross output	3,202		1.0000

Lead production and refining

Country: Morocco
Input structure of industry ISIC No. 342
Year 1964

		Absolute Values $'000		Input coefficients
		Total	of which imported	2 as % of 1
0		5,112		.7332
1				
20				
21				
22				
23				
24				
25				
26		6		.0009
27		6		.0009
28				
29				
30		2		.0003
31		26		.0037
32		242		.0347
33		14		.0020
34		12		.0017
35		6		.0009
36/37				
38				
39				
4		2		.0003
5		78		.0112
61)				
62/63)				
64)				
7)		192		.0275
8/9)	ex. 7	88		.0126
Total intermediate inputs		5,786		.8299
Salaries and wages		592		.0849
Indirect taxes less subsidies		80		.0115
Depreciation		110		.0158
Profit		404		.0580
Total gross output		6,972		1.0000

Rolling and wire drawing

Country: Morocco
Input structure of industry ISIC No. 342
Year 1964

	Absolute values $'000		Input coefficients
	Total	of which imported	2 as % of 1
0			
1			
20			
21			
22			
23			
24			
25			
26	4		0.0016
27	92		0.0368
28			
29			
30	2		0.0008
31	50		0.0200
32	8		0.0032
33	2		0.0008
34	99.8		0.3992
35	25.8		0.1032
36/37	2		0.0016
38			
39			
4	2		0.0016
5	26		0.0104
61			
62/63			
64			
7	10		0.0040
8/9 ex 7	68		0.0272
Total intermediate inputs	1,502		0.5994
Salaries and wages	378		0.1509
Indirect taxes less subsidies	72		0.0287
Depreciation	100		0.0399
Profit	454		0.1812
Total gross output	2,506		1.0000

ANNEX IV

Trade in iron and steel 1964

($'000)

	Morocco	Algeria	Tunisia	Libya	UAR	Sudan
Exports*	-	0.3	-	-	3.3	-
Own production	2.1	3.5	0.5	0.5	81.4	-
Imports	28.0	41.7	14.1	26.8	40.2	13.1
Home market	30.1	44.9	14.6	27.3	118.3	13.1

* Almost entirely outside Africa.

Trade in non-ferrous metals 1964

($'000)

	Morocco	Algeria	Tunisia	Libya	UAR	Sudan
Exports*	2.6	0.3	3.0	-	-	-
Own production	6.2	2.5	3.3	-	18.4	-
Imports	5.4	3.9	1.5	0.9	2.1	1.3
Home market	8.9	6.1	1.8	0.9	20.5	1.3

* Almost entirely outside Africa.

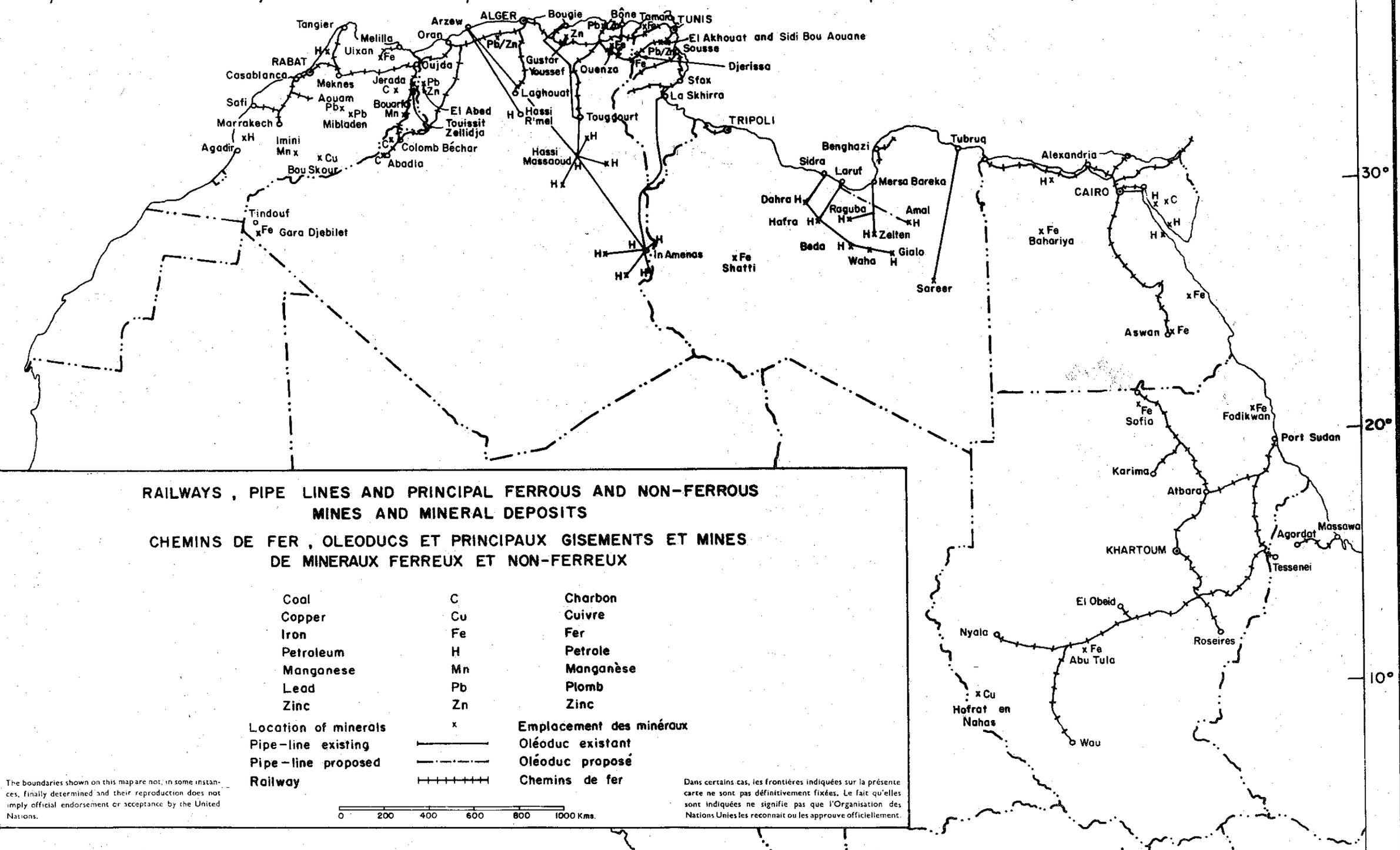
Trade in iron and steel 1980

($ million)

Import from / into	Morocco	Algeria	Tunisia	Libya	UAR	Sudan	Other countries	Total
Morocco	-	23.4	6.5	-	6.6	-	15.8	52.3
Algeria	4.1	-	5.9	-	7.2	-	19.0	36.3
Tunisia	1.1	8.2	-	-	3.0	-	7.7	20.0
Libya	1.7	21.8	2.2	-	2.9	-	16.9	45.5
UAR	-	-	-	-	-	-	47.5	47.5
Sudan	-	-	-	-	17.1	-	5.9	23.0
Other countries	-	-	-	-	-	-	-	-
Total	7.0	53.4	14.6	-	36.8	-	-	111.8
Own production	34.5	117.2	35.6	14.8	251.0	9.8	-	462.9
Imports	52.3	36.3	20.0	45.5	47.5	23.0	-	224.6
Home market	79.8	100.1	41.0	60.3	261.7	32.8	-	575.7

Trade in non-ferrous metals 1980

Import from / into	Morocco	Algeria	Tunisia	Libya	UAR	Sudan	Other countries	Total
Morocco	-	17.0	-	-	10.9	-	4.8	32.7
Algeria	1.6	-	-	-	41.4	-	9.7	52.7
Tunisia	0.6	7.5	-	-	4.8	-	1.5	14.4
Libya	0.7	9.3	-	-	5.9	-	1.8	17.7
UAR	3.9	6.5	-	-	-	-	86.7	97.1
Sudan	0.4	0.6	-	-	7.8	-	1.1	9.9
Other countries	34.8	6.2	7.2	-	6.5	-	-	-
Total	42.0	47.1	7.2	-	77.3	-	-	173.6
Own production	65.9	69.8	16.4	11.8	148.2	6.4	-	318.5
Imports	32.7	46.7	14.4	17.7	97.1	9.9	-	218.5
Home market	56.6	69.4	23.6	29.5	168.0	16.3	-	363.4



RAILWAYS, PIPE LINES AND PRINCIPAL FERROUS AND NON-FERROUS MINES AND MINERAL DEPOSITS

CHEMINS DE FER, OLEODUCS ET PRINCIPAUX GISEMENTS ET MINES DE MINERAUX FERREUX ET NON-FERREUX

Coal	C	Charbon
Copper	Cu	Cuivre
Iron	Fe	Fer
Petroleum	H	Petrole
Manganese	Mn	Manganèse
Lead	Pb	Plomb
Zinc	Zn	Zinc
Location of minerals	x	Emplacement des minéraux
Pipe-line existing		Oléoduc existant
Pipe-line proposed		Oléoduc proposé
Railway		Chemins de fer

0 200 400 600 800 1000 Kms.

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